INSTALLATION & SERVICE MANUAL

Models
FH-510 FH-515 FH-720
Remote Dispensers

PMC

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PEI PETROLEUM EQUIPMENT INSTITUTE

ETL Listed

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IMPORTANT

Examine the shipment immediately on arrival to ensure there has been no damage or loss in transit. Pump Measure Control, Inc. (PMC), as shipper, is not liable for the hazards of transportation.

Read all instructions and tags concerning the dispenser carefully and entirely before starting the installation. An improperly installed dispenser is dangerous and is likely to be a source of ongoing problems.

This manual covers both RETAIL and COMMERCIAL versions of the dispenser. Any references to PRICE settings or PENNY PULSE outputs only apply to the RETAIL versions. Differences are noted where necessary.

Installation

All PMC dispensers must be installed according to all applicable NEC, NFPA and local codes. The installation portion of this manual is intended to provide some points to watch for when designing and installing the system the dispenser is to operate with. It is the responsiblility of the installer and end customer to ensure that the entire system (tanks, pumps, dispensers, etc.) is designed and installed correctly.

A. Piping

1. ***The remote dispensers covered by this manual must be fed product through a system that will maintain near operating pressure on the dispensers when the pump is off. If pressure is not maintained on the unit, the reel's hose can expand each time the pump is turned ON, causing the dispenser to jump a few counts at the start of a transaction Some submersible pumping systems provide this capability as part of the device. However, if a pumping unit is used that does not maintain pressure, a check valve with thermal relief must be installed at the outlet of the pump. The check valve should be spring loaded to provide a good positive seal.***
2. Each dispensers should be installed over a sump with provision to mount a LISTED emergency shut off valve. The shut-off valve is installed to stop the flow of fuel to the dispenser in the event of fire or if the dispenser is knocked off the island. The FH-xxx dispenser footprint can be seen in **Figure 3** below. The general footprint is the same for all models.

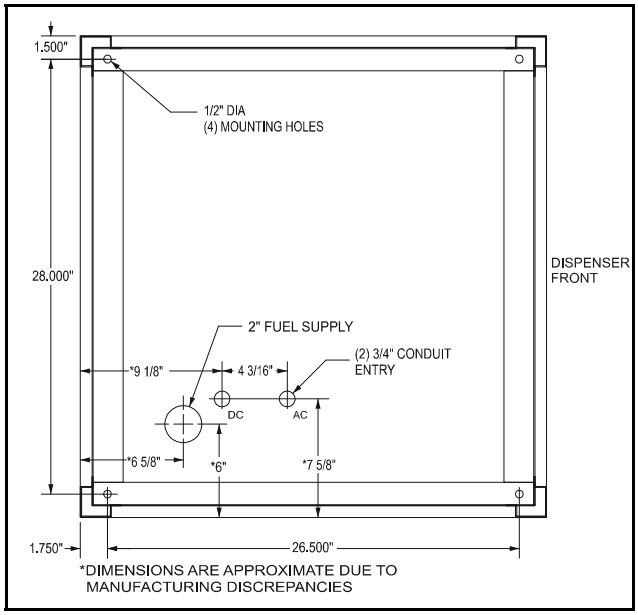


Figure 3– Fuelhouse dispenser footprint for unit with underground fuel supply feed.

3. ***The Fuelhouse dispenser must be installed in a system that prevents air from being pumped through the dispenser. Submersible turbine pumps do not tend to pump air. However, if another type of pumping device is used, means must be provided to eliminate air from the system before it reaches the dispenser.***
4. ***The Fuelhouse dispenser must be installed in a system that incorporates a power operated pump incorporating a pressure relief that maintains system pressures at or below 50 psi.***
5. Dispensers should be located as close to the supply tank as possible. Supply lines should be sized to allow simultaneous maximum flow desired for all dispensers fed from that supply.
6. The vertical supply riser must be cut to the proper height in order to avoid undue stress on the dispenser when installing the ground joint union. Attach dispenser base to the sump/impact box using the anchor points.
7. When the dispenser has been connected to the piping, the lines should be tested for leaks. Remember to allow any fresh pipe compound used in threaded joints to cure or set before performing the leak tests.
8. All hoses used with the dispensers shall be sufficiently reinforced as to not affect the operation or accuracy of the units through its expansion and contraction from pressure.

B. Electrical Wiring

1. All electrical wiring should be done by a qualified licensed electrician. All wiring must follow National Electrical Code and satisfy all local rules and regulations.
2. Only factory provided equipment is to be installed in the head of the dispenser.
3. The vapor barrier at the base of the head MUST remain as shipped form the factory. DO NOT drill or punch any hoses in this barrier!
4. All field wiring is to be connected to the dispenser in the unit's junction box.
5. The dispenser is shipped from the factory internally wired as shown in wiring drawings **91-02A20 and 91-02A21** in Section 4.
6. Refer to electrical wiring diagrams in Section 4 for details on wiring the dispenser to the field.

C. Start-Up

1. Make sure all filtration and / or strainers are in place prior to filling the piping system with product. Any loose debris in the piping must be prevented from passing through the meter where it can cause damage. Some Fuelhouse series dispensers have filtration on the inlet to the meter.
2. ***IT IS IMPORTANT TO BLEED THE AIR FROM THE LINES <u>VERY SLOWLY</u>. RUNNING THE METER RPM UP ON AIR PUSHED THROUGH THE SUPPLY LINE AHEAD OF THE PRODUCT CAN CAUSE SEVERE, AND OFTEN TOTAL, DAMAGE TO THE METER.***

IMPORTANT

BLEED THE AIR FROM THE LINES <u>VERY SLOWLY</u>. ALLOWING THE METER TO REACH EXCESSIVE RPM CAN CAUSE SEVERE DAMAGE.

3. After all air has been removed from the supply piping, run 30 to 40 gallons of product through the dispenser to completely fill the system and discharge all air from the unit.
4. Although the dispensers are shipped from the factory properly adjusted, rough handling in transit or special installation conditions can alter this. Before the dispensers are placed into service, their calibration should be verified and any necessary changes made. Refer to the section detailing dispenser calibration.
5. Before placing unit in service, verify that all displays and the totalizer are functioning properly.

Programming

1. The dispensers main CPU board is located behind the front display panelin the unit's head. The CPU board has several items that must be configured so that the dispenser will operate correctly with the system in which it is installed**.**

IMPORTANT

IF CPU IS EQUIPPED WITH A RED 120040x-FH COMMUNICATIONS DAUGHTER BOARD, SEE APPENDIX 'A AND SKIP ITEM #2 BELOW.

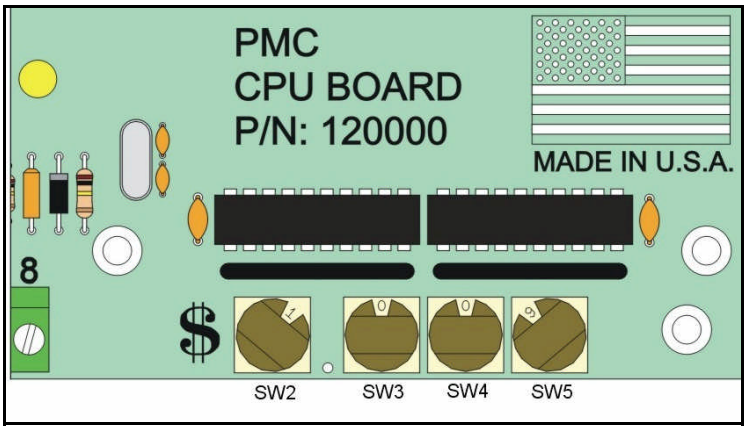


Figure 5A - Corner of CPU board showing price setting switch locations. Note that price setting only applies to RETAIL dispensers.

2. **PRICE PER VOLUME*: (RETAIL versions only)*** Setting the price per unit volume of product is done using four rotary switches located in the lower right corner of the board. See **Figure 5A.** SW2 sets the dollar amount, SW3, SW4 and SW5 set the 10¢, 1¢, and 0.1¢ amounts, respectively. For a price of 1.399 per gallon, switches 2 thru 5 would be set to 1, 3, 9, & 9. Note: If price is set to '0.000', the dispenser will not activate.
3. **DIP SWITCH and JUMPER SETTINGS:** The dips switches and jumpers on the main CPU board are used to set operational parameters on start up of the unit. See **Figure 5B** for location. While dip switch settings can be reset to original positions once altered, changes in the jumper block are **permanent**. To cut a jumper, press a sharp object through the thin point of the metal foil for the desired position. (If wire jumpers are used instead of the foil block depicted in Figure 5B, simply cut the desired jumper with a small pair of wire cutters). To repair a jumper that has been cut, the board must be returned to the factory. The parameters that the switches and jumpers control are defined in the following tables.

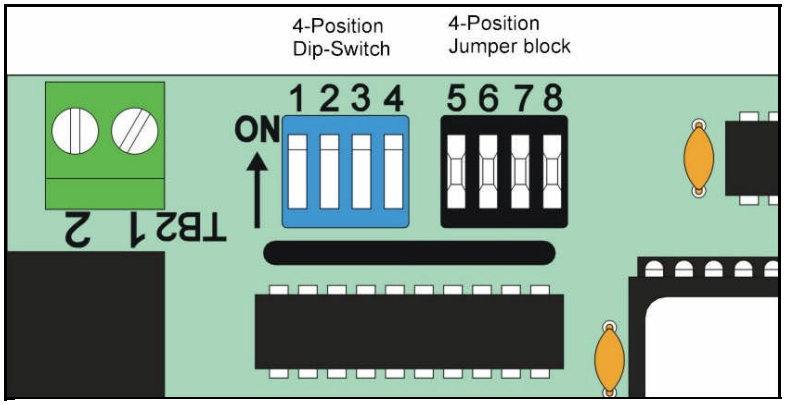


Figure 5B - Section of CPU board showing dip switch and jumper location

IMPORTANT

AFTER CHANGING ANY SETTING, THE CPU BOARD MUST BE RESET BY CYLING POWER OR PRESSING THE RESET BUTTON.

DIP SWITCH PARAMETERS	**Position**
Dispenser Operating Mode (Table 6A)	1
Volumetric Pulse Resolution (Table 6B)	2
Display TEST (Table 6C)	3
Hose Reel Pre-pressurization (Table 6D)	4

JUMPER PARAMETERS	**Position**
Liters / Gallons Unit of Measure (Table 6D)	5
FH Model Selection (Table 6E)	6
Volume or Penny Pulse Output (Table 6F)	7
UNUSED	8

Parameter settings are detailed in tables on next page

Programming Tables

Dip Switch positions 1-4 and Jumper Positions 5-8

DIP SWITCH SETTINGS

TABLE 6A - Position #1

	Dip Switch Position #1
Requires external 110VAC Permissive from card system or terminal	OFF*
Stand-alone mode	ON

Dispenser Operating Mode

If the dispenser is controlled by a console or card system, then this position should be set to OFF. Setting this to ON bypasses the requirement for an external authorize signal to the dispenser. If a 120040x-FH communications daughter board is installed, See Appendix 'A'.

TABLE 6B - Position #2

	Dip Switch Position #2
10 pulse per unit volume	OFF*
100 pulses per unit volume	ON

Volumetric Pulse-out Resolution

If the pulse output type (see Table 6E below) is set for Volumetric, then this setting determines the resolution of the signal. If the pulse output type is set to PENNY pulse, this setting has no effect.

TABLE 6C - Position #3

	Dip Switch Position #3
Display Segment Test	OFF*
No Display Segment Test	ON

Display Segment Test

Set whether to have the Display Segment Test or not. If selected, the dispenser will show all '8' digits for 5 seconds, then reset and open the solenoid when the unit is enabled to dispense.

TABLE 6D - Position #4

	Dip Switch Position #4
Hose Reel Pre-pressurization Disabled	OFF*
Hose Reel Pre-pressurization Enabled	ON

Hose Reel Pre-pressurization

Helps eliminate meter jump from hose pressurization when dispenser is used with long hoses.

JUMPER SETTINGS

TABLE 6D - Position #5

	Jumper Position #5
LITERS	CUT
GALLONS	SHORTED*

Liters / Gallons Unit of Measure

Set the Unit of Measure for the dispenser. Default is US Gallons. If Liters is desired, then CUT the foil or jumper on POSITION #5.

TABLE 6E - Position #6

	Jumper Position #6
NOT VALID	CUT
FH-510, FH-515, FH-720	SHORTED*

Dispenser Model

Set MODEL of dispenser the CPU board is installed in. Default is FH-510, FH-515 or FH-720. At this time, this is the only valid setting for this position.

TABLE 6F - Position #7

	Jumper Position #7
Volumetric Pulse Output	CUT
Penny Pulse Output	SHORTED*

Pulse Output Type

Set the pulse output channel to either VOLUMETRIC or PENNY pulse out. If VOLUMETRIC is selected, Table 6B above determines resolution. If PENNY is selected , a pulse per penny of the TOTAL SALE is transmitted.

**** = default setting***

Note: Jumper position #8 is not used at this time.

Operation

1. To start the dispenser, simply remove the nozzle from its boot and lift the ON/OFF lever. If the dispenser is stand alone or is authorized to dispense by a control system, the dispenser will reset and be ready to dispense.
2. After delivery is complete, the ON/OFF lever is pushed down and the nozzle returned to its boot. This will end the transaction.
3. During delivery, TOTAL SALE and VOLUME delivered will be displayed on the face of the dispenser. At the completion of a transaction, this information will remain on the displays until the next transaction is started. (for commercial versions of the dispensers, only VOLUME is displayed).
4. During delivery, the CPU board in the dispenser will generate a real time output pulse stream for use by remote devices. The CPU board can be configured to transmit a VOLUMETRIC or PENNY pulse stream (See Programming Section of Manual for details). The pulse output driver is an open-collector type. See Fuelhouse Dispenser Control in Section 4.

Maintenance

The Fuelhouse dispensers are designed to give many years of trouble free service. However, like any mechanical device, they require periodic maintenance to prevent problems from developing. Below is a recommended service routine to maintain top performance from the unit.

IMPORTANT

BEFORE OPENING ANY PART OF THE FUEL SYSTEM, MAKE SURE IT IS DE-PRESURIZED AND THE PUMPING SYSTEM HAS BEEN SHUT-OFF AND TAGGED OUT.

Monthly:

1. Fully extend the hose from the dispenser and carefully inspect it for any signs of wear or damage. If wear or damage is present that may affect the safety of the hose, replace it.
2. Check the inlet fuel filter(s) and change if necessary.
3. Inspect the rechargeable batteries installed on the electronics boards in the dispenser head for signs of leakage. If a battery is leaking, replace it and properly dispose of the defective one.
4. Clean the exterior of the dispenser cabinet, using only non-abrasive, non-corrosive cleaning agents and soft rags.

Semi-annual:

1. Inspect the hose reel swivel for any signs of leakage. If a swivel leak is detected at the swivel point, replace the cup seal. If the swivel is leaking from the NPT threaded connection where it attaches to the reel, remove the swivel, re-dope the threads with listed gas-oil resistant thread compound and reinstall. This is not a normal failure, and usually only occurs if the swivel was not initially installed properly.
2. Grease the swivel using the grease fitting located on it. Care must be taken not to over pack the bearing with grease. In normal operation, the swivel should turn freely. If the swivel becomes excessively hard to turn, the cause may be over packing of the bearing or failure of the bearings themselves. If over packing has occurred, simply remove and reinstall the grease fitting from the swivel to relieve the excessive pressure. If the swivel's bearings are damaged, the swivel assembly must be replaced.
3. Inspect the reel's main bearings that the drum rotates on. The bearing material is Delrin and a typical sign of damage is cracking. If damage is detected, replace the bearing.
4. The roller assembly installed on the front of the dispenser protects the hose from damage as it is reeled in and out of the dispenser. Check each roller tube for damage. Typical wear damage is cracking of the Delrin inserts in the ends of the roller tubes. Abuse of the rollers can also result in one or more of the tubes being bent. This usually only occurs if the roller is subject to an impact force such as being kicked or struck by a vehicle. If roller damage is detected, replace the defective part.
5. In SALT-WATER environments, it is recommended that the exterior stainless steel panels be waxed to maintain the panels at their best appearance.

Annual:

1. Replace the rechargeable batteries located on the display and CPU boards in the dispenser's head. Replace only with a 7.2V or 8.4V rechargeable battery (Ni-Cd or NiMH). DO NOT REPLACE WITH AN ALKALINE BATTERY as the battery charging circuit on the board may cause the battery to leak or explode.
2. As a preventive measure, the cup seal in the reel's swivel should be replaced.

Rewinding Hose onto the Reel

1. The electric hose rewind is activated by pressing the "HOSE RETURN" button on the upper right of the dispenser face. When pressed, the reel will immediately begin retrieving hose. Make sure the hose is clear of any obstructions and individuals before pressing the button. Operation of the electric hose rewind should only be performed by trained facility operators.
2. As the hose is retrieved on to the reel, care should be taken to make sure the hose is wound in layers evenly across the reel drum. This will ensure hose is wound on the reel most efficiently without any high spots. High spots in the hose wind that protrude beyond the reel's side panels may catch the dispenser frame and jam the reel or cause damage to the dispenser.
3. When retrieving the hose on to the reel, minimize the amount that the hose drags across the ground. Continuous abrasion of the hose on rough surfaces will greatly reduce the life of the hose.
4. The rewind motor is not rated for continuous duty. Care MUST be taken to avoid overheating the motor. During normal use, this is not a problem in that a full hose retrieval will only take a few seconds. However, if the motor is allowed to run continuously, it will overheat. Overheating the motor will significantly reduce its life.

Dispenser Calibration

The purpose of calibrating a dispenser is to ensure that the volume displayed on the unit matches the amount of product dispensed. The calibration of the Fuelhouse dispenser is accomplished by adjusting the correction factor set on the 110500C Factor Board *(see Figure 7)* located in the head of the dispenser. The factor board manipulates the raw pulse stream produced by the pulser mounted to the dispenser's meter. The correction factor has the form of **XXX.XX%** and has a valid range 000.01% to 199.99%. It is applied as a percentage multiplier to the pulse streams passing through the board. For example, if the meter transmits 410 pulses per gallon and the correction factor is set to 97.56%, then the CPU board will receive 400 pulses per gallon.

To access the factor board, remove the rear panel from the head of the dispenser. The factor board is located on the right side of the opening under a rectangular, tamper resistant cover. The cover is held in place by two screws and secured by a seal wire to prevent tampering.

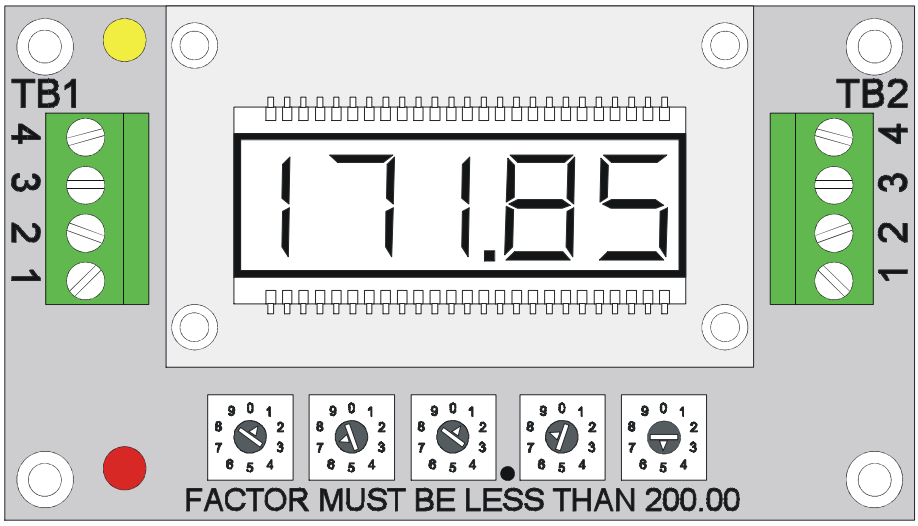


Figure 7—110500 Factor Board

Calibration Procedure:

1. Check the dispenser's current calibration by delivering product to a reliable, accurate prover. The prover should large enough to accept product from the dispenser at full flow for at least 60 seconds. Perform several delivery tests to verify repeatability.
2. Make sure the prover has been wetted and run a test load. Note the volume in the prover and the volume registered by the dispenser.
3. If the unit's calibration needs to be corrected, then the factor setting on the factor must be changed. Remove the cover from the factor board by cutting the seal wire. Record the current setting on the factor switches and use the following formula to determine the what the new setting should be:

$$\text{New factor} = \frac{\text{(volume in prover)}}{\text{(volume in prover registered by dispenser)}} \times \text{current factor}$$

4. Set the new factor setting on the 110500 Factor Board.
5. Run another prover test to verify the new adjuster setting is correct.
6. If the calibration of the unit needs further correction, repeat the above procedure. If no further changes are needed, replace the cover on the factor board.
7. Apply a wire seal to secure the adjuster settings.

Example: *A prover run is completed in a 100 gallon prover. The prover shows exactly 100.00 gallons while the dispenser shows 99.35 gallons on the display. If the current factor setting is 72.01, the new factor that needs to be set on the board is 72.48 to correct the dispenser's registration to that of the prover.*

NOTE: 1 US GALLON = 231 cubic inches

Parts List for FH-510

Description	Part Number	Comments
Meter	M-5-1 (Class 1)	See parts exploded view (page 13)
Pulser	Liquid Controls POD1	See pulser documentation (page 43)
Solenoid Valve (DIESEL)	EF8210G022V	See solenoid paperwork (page 34)
Solenoid Valve (GASOLINE)	EF8210G022V	See solenoid paperwork (page 34)
Solenoid valve repair kit (VITON)	K302280V	See solenoid paperwork (page 34)
Solenoid coil replacement kit (120VAC—60Hz)	238214-032-D	See solenoid paperwork (page 30)
Flexible Hose	93-20310012	
Filter Housing	40-FLTR50163	
Filter - 30 Micron Particulate	40-FLTR70020	
Filter - 10 Micron Bio-Tek	40-FLTR70024	
CPU Board	120000	
Large display board	120500	
Thumbscrew for rear cover	35-32035	
Hose Reel Parts	See parts list (pages 26-27)	
Reel Rewind Switch	60-4B689 & 60-4B696	
SST removable door panel	20-FH1511-6	
SST rear wide panel	20-FH1512-6	
SST front / rear narrow panel	20-FH1513-6	
SST front wide panel	20-FH1514-6	
SST top	20-FH1515-6	
SST Face Plate (RETAIL)	20-FH1518-SS	
SST Face Plate (COMMERCIAL)	20-FH1524-SS	
Key lock mechanism	CL-58	
Door lock key	LS-300	
On/Off Lever Sensor	65-PRX-1	
Nozzle boot / On-Off Lever	NB-2	

Parts List for FH-515

Description	Part Number	Comments
Meter	M-5-1 (Class 1)	See parts exploded view (page 13)
Pulser	Liquid Controls POD1	See pulser documentation (page 35)
Solenoid Valve (DIESEL)	EF8210G100V	See solenoid paperwork (page 34)
Solenoid Valve (GASOLINE)	EF8210G100V	See solenoid paperwork (page 34)
Solenoid valve repair kit (VITON)	K304355V	See solenoid paperwork (page 34)
Solenoid coil replacement kit (120VAC—60Hz)	238214-032-D	See solenoid paperwork (page 30)
Victaulic Coupling	40-75-2.0”	
Filter Housing	40-FLTR50011	
Filter - 30 Micron Particulate	40-FLTR70020	
Filter - 10 Micron Bio-Tek	40-FLTR70024	
CPU Board	120000	
Large display board	120500	
Thumbscrew for rear cover	35-32035	
Hose Reel Parts	See parts list (pages 26-27)	
Reel Rewind Switch	60-4B689 & 60-4B696	
SST removable door panel	20-FH1511-6	
SST rear wide panel	20-FH1512-6	
SST front / rear narrow panel	20-FH1513-6	
SST front wide panel	20-FH1514-6	
SST top	20-FH1515-6	
SST Face Plate (RETAIL)	20-FH1518-SS	
SST Face Plate (COMMERCIAL)	20-FH1524-SS	
Key lock mechanism	CL-58	
Door lock key	LS-300	
On/Off Lever Sensor	65-PRX-1	
Nozzle boot / On-Off Lever	NB-2	

Parts List for FH-720

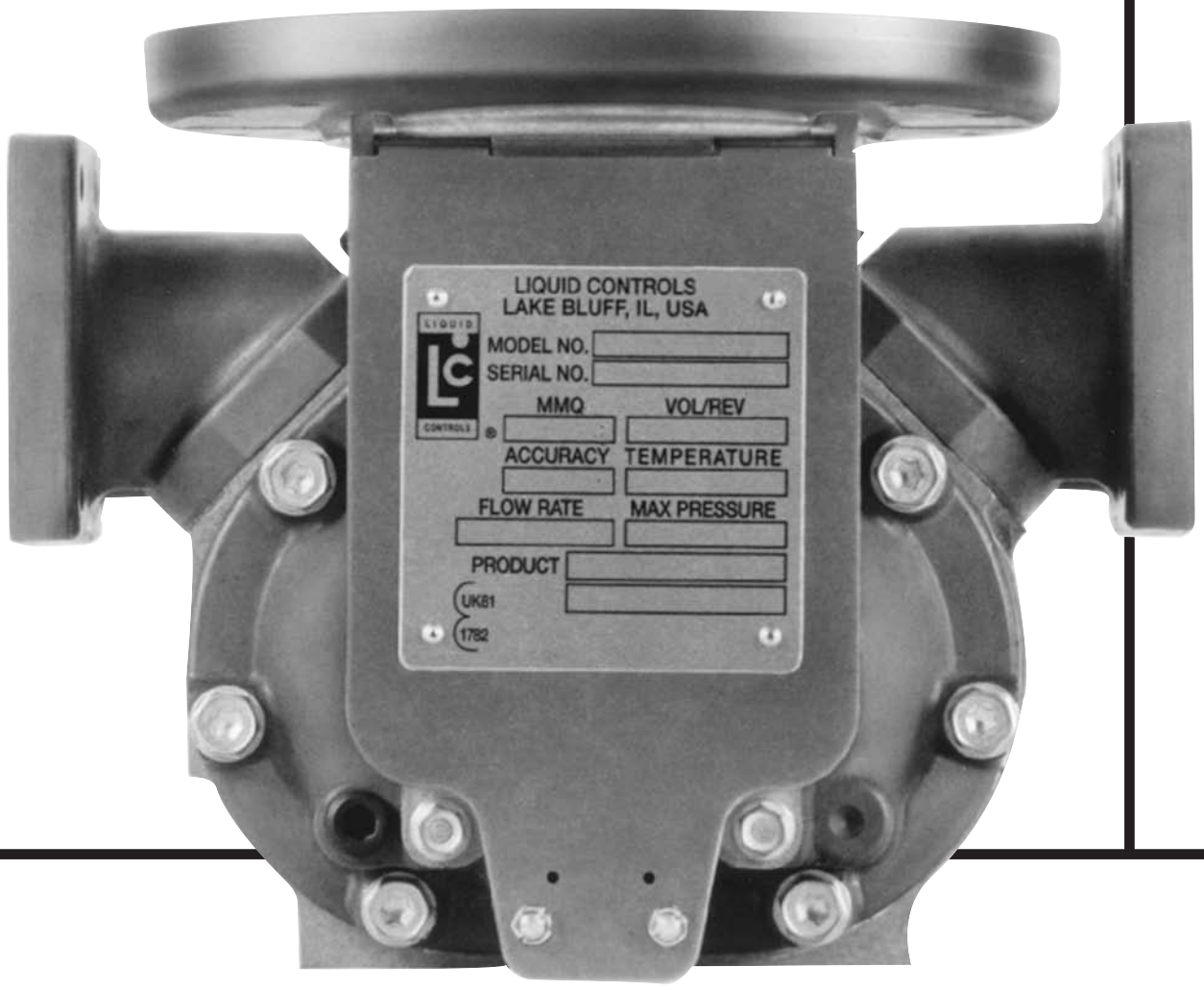
Description	Part Number	Comments
Meter	M-7-1 (Class 1)	See parts exploded view (page 19)
Pulser	Liquid Controls POD1	See pulser documentation (page 35)
Solenoid Valve (DIESEL)	EF8210G100V	See solenoid paperwork (page 34)
Solenoid Valve (GASOLINE)	EF8210G100V	See solenoid paperwork (page 34)
Solenoid valve repair kit (VITON)	K304355V	See solenoid paperwork (page 34)
Solenoid coil replacement kit (120VAC—60Hz)	238214-032-D	See solenoid paperwork (page 30)
Victaulic Coupling	40-75-2.0”	
Filter Housing	40-FLTR50011	
Filter - 30 Micron Particulate	40-FLTR70020	
Filter - 10 Micron Bio-Tek	40-FLTR70024	
CPU Board	120000	
Large display board	120500	
Thumbscrew for rear cover	35-32035	
Hose Reel Parts	See parts list (pages 26-27)	
Reel Rewind Switch	60-4B689 & 60-4B696	
SST removable door panel	20-FH1511-6	
SST rear wide panel	20-FH1512-6	
SST front / rear narrow panel	20-FH1513-6	
SST front wide panel	20-FH1514-6	
SST top	20-FH1515-6	
SST Face Plate (RETAIL)	20-FH1518-SS	
SST Face Plate (COMMERCIAL)	20-FH1524-SS	
Key lock mechanism	CL-58	
Door lock key	LS-300	
On/Off Lever Sensor	65-PRX-1	
Nozzle boot / On-Off Lever	NB-2	

PARTS MANUAL

M-5®, MA-5®, MA-4®, & P9560 Series Meters

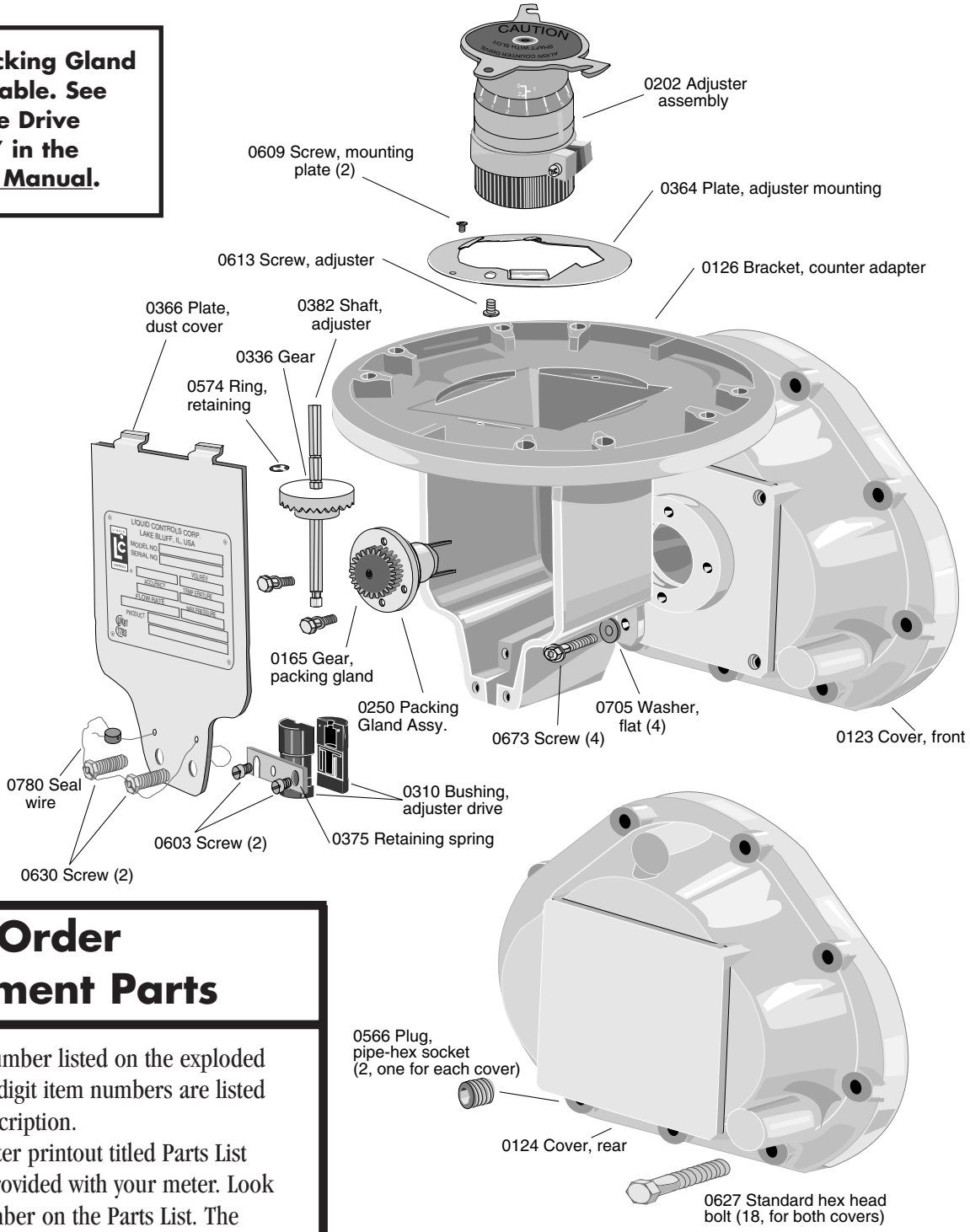
LIQUID CONTROLS
A Unit of IDEX Corporation

IDEX
IDEX CORPORATION



Exploded View: M-5/MA-5/MA-4 Meter Covers

The 0250 Packing Gland is field servicable. See "Servicing the Drive Components" in the M/MA Meter Manual.



How to Order Replacement Parts

1. Find the item number listed on the exploded drawing. The 4 digit item numbers are listed with a word description.
2. Find the computer printout titled Parts List that has been provided with your meter. Look up the item number on the Parts List. The Parts List shows each item number with a corresponding part number. Find the corresponding 5 digit part number for the item you want to order. The part number represents an individual piece, a kit or a complete assembly.
3. Inform your distributor of the part number that you need. The part number is the only number that allows the distributor to find the correct component for your meter.

LIQUID CONTROLS
LAKE BLUFF, IL, USA

MODEL NO.

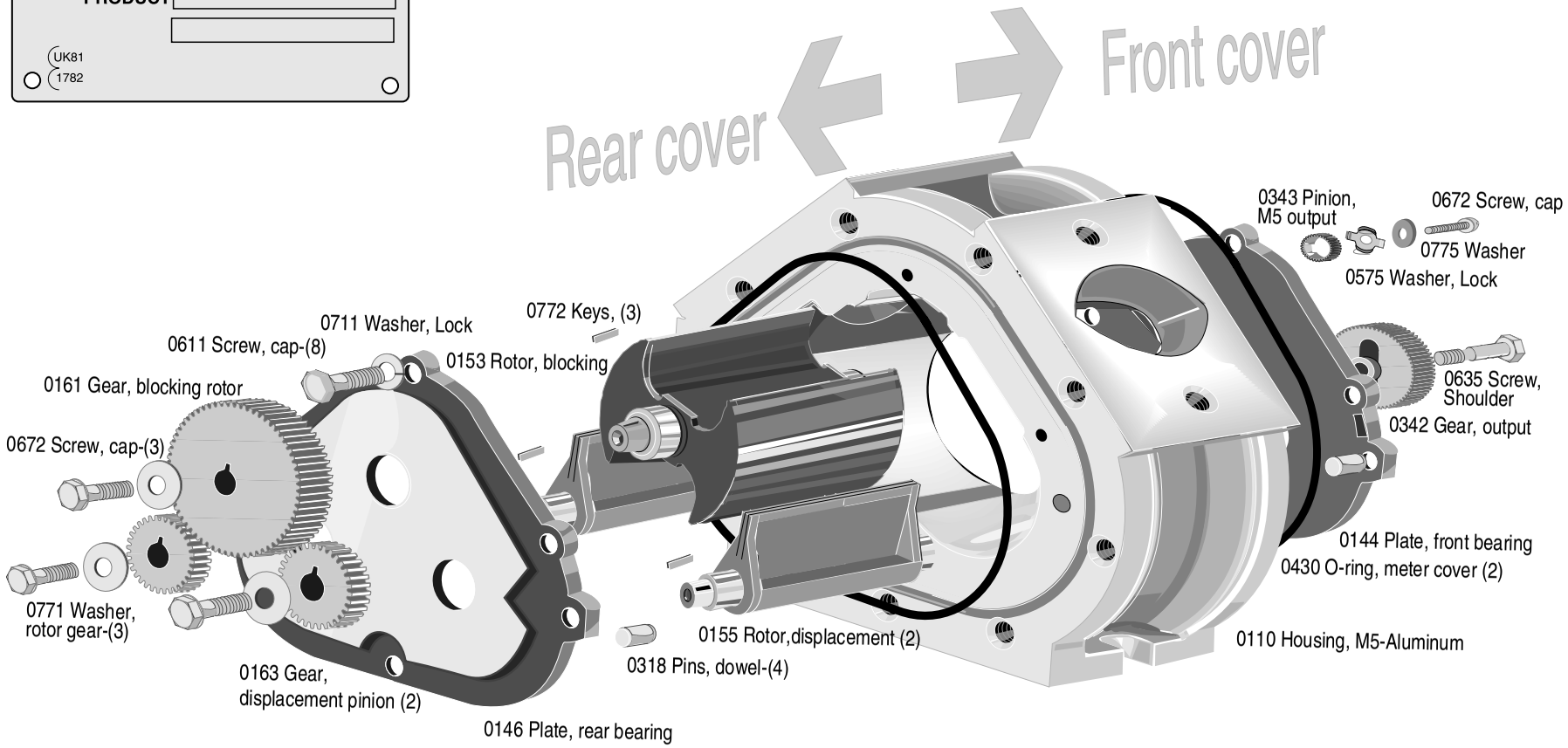
SERIAL NO.

MMQ	VOL/REV
ACCURACY	**TEMPERATURE**
FLOW RATE	**MAX PRESSURE**

PRODUCT

UK81
1782

When placing order for replacement parts please reference the meter's serial number.



Exploded View: M-5/MA-5/MA-4 Meter Element

OWNERS MANUAL PARTS LIST - M5A1-LP

	ITEM	PART#	DESCRIPTION		QTY
COMPONENT		L1102	METER ELEMENT	M-5-1 FOR FORK DRIVE	1
	0678	00306	SCREW, DRV #2 x 0.19	TYPE 'U'	2
	0611	09079	SCREW, #10-24 X 0.625	HX HD, SEMS, SS	8
	0672	09079	SCREW, #8-32 X 0.750 LG	HEX HD 18-8 STAINLESS STL	4
	0318	40665	PIN, DOWEL	0.250 DIA X 0.625 LOND	4
	0146	44286	PLATE, REAR BEARING	R B/P SV-1-2-3-7-14	1
	0144	44287	PLATE, FRONT BEARING	FR B/P SV-1-2-3-7-14	1
	0155	48078	ROTOR ASSY, DISP M5	ALUM / SS HC	2
	0153	48079	ROTOR, BLKG ASSY M5	ALUM / SS HC	1
	0163	48089	GEAR, DISPL PINION M5	SINTERED IRON, TAPER	2
	0161	48090	GEAR, BLOCKING M5	SINTERED IRON, TAPER	1
	0343	48257	PINION, M5 OUTPUT	SST 32P, 18T	1
	0110	48271	HOUSING, M5 ALUMINUM	FOR 2 BOLT ELBOWS	1
	0635	48275	SCREW, SHOULDER 0.25D	M5 OUTPUT GEAR	1
	0342	48276	GEAR, OUTPUT M5	SINTERED IRON 32P 54T	1
	0575	48277	WASHER, LOCK M5	OUTPUT PINION	1
	0771	48319	WASHER, ROTOR GEAR	0.19 ID, 0.62 OD, 301 SS	1
	0772	48345	KEY, ROTOR GEAR M5	0.093 X 0.125 X 0.437	3
COMPONENT		25109	COVER ASSY M5	ALUM COVERS, NEW STYLE	1
	0566	06790	PIPE PLUG, 0.250-18 NPT	HEX SCKT HD, 302 SS	2
	0627	09080	SCREW, 0.312-18 X 1.375	HEX WSHR HD, THD FRMG	18
	0123	48272	COVER, FRONT M5	ALUM, NEW STYLE	1
	0124	48273	COVER, REAR M5	ALUM, NEW STYLE	1
COMPONENT		25127	SEAL KIT	M/MA 5 UL BUNA ALUM	1
	0430	09278	O-RING, 5.267 ID BUNA, UL	5.435 OD X 0.099 THK (SQR)	2
COMPONENT		A1070	ELBOW ASSY, M5 - 2 BOLT	ALUM / BUNA - 1.5" 45 DEG	2
	0003	09082	SCREW, 3/8-16 X 1.375"	HX WSHR HD, T45, SS	4
	0002	09117	0-RING, 2.31 ID BUNA-N	2.50" OD X 0.09 DIA WALL	2
	0001	48290	ELBOW, M-5 2 BOLT	1-1/2" 45 DEGREE	2
COMPONENT		A2110	FLANGE ASSY, M5 & M7	ALUM / BUNA / 1-1/2" NPT	2
	0750	04498	FLAT WASHER, 0.406 ID	0.812 OD X 0.062 THK	8
	0420	06854	O-RING, 2.88" ID BUNA-N UL	3.12 OD X 0.12 DIA WALL	2
	0135	48397	FLANGE, COMP; 1-1/2" NPT	ALUM, O-RING STYLE	2
	0620	06851	SCREW, 3/8-16 X 1.500	HEX HD CAP, GR 8	8

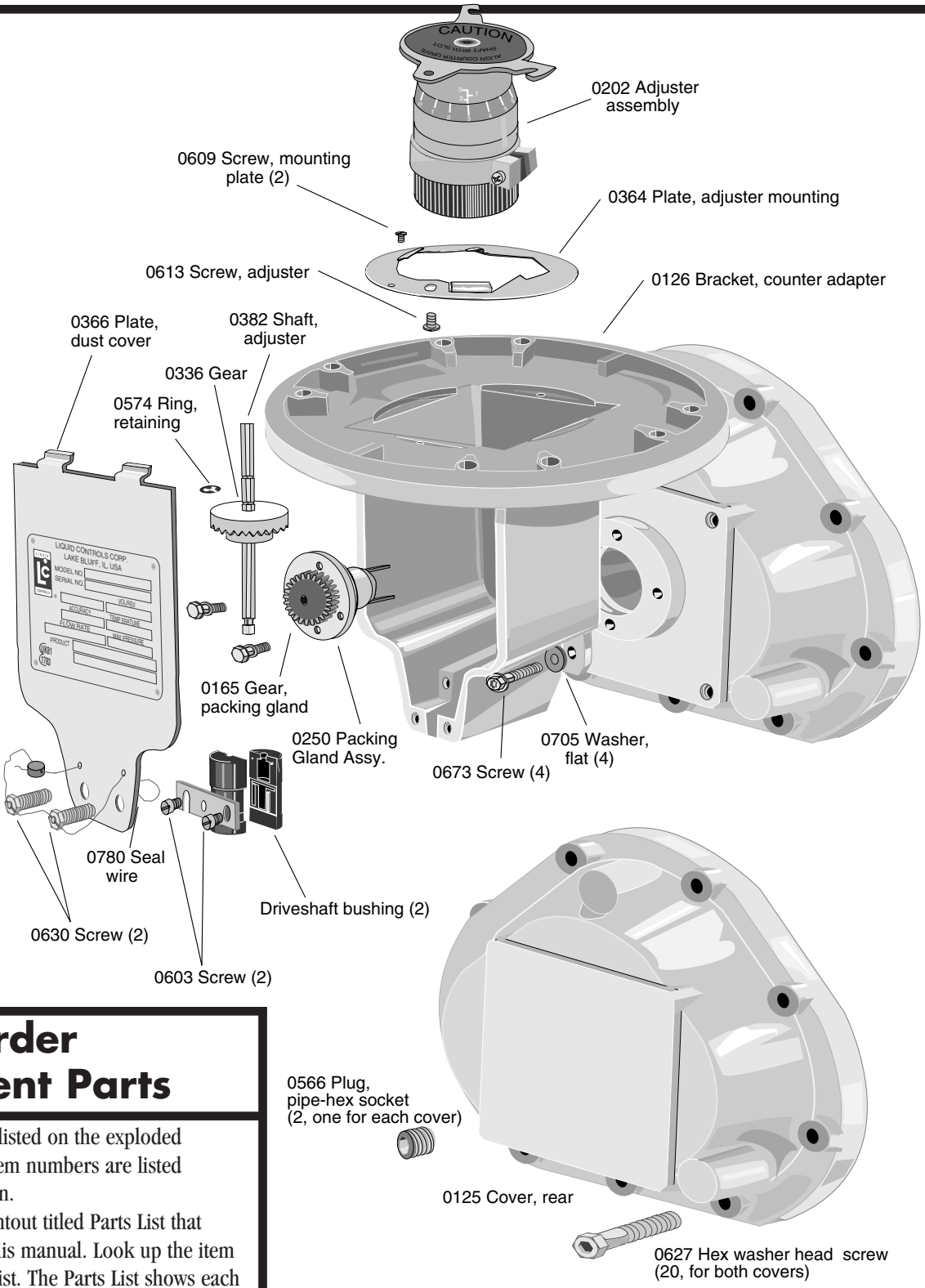
PARTS MANUAL

M-7,® MA-7,® M-10® Meters

LIQUID CONTROLS
A Unit of IDEX Corporation

IDEX CORPORATION

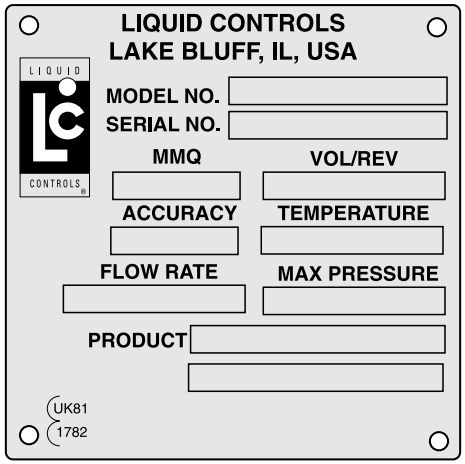
Exploded View: M-7/MA-7/M-10 Meter Covers


0202 Adjuster assembly
0609 Screw, mounting plate (2)
0364 Plate, adjuster mounting
0613 Screw, adjuster
0126 Bracket, counter adapter
0366 Plate, dust cover
0382 Shaft, adjuster
0336 Gear
0574 Ring, retaining
0165 Gear, packing gland
0250 Packing Gland Assy.
0705 Washer, flat (4)
0673 Screw (4)
0780 Seal wire
0630 Screw (2)
0603 Screw (2)
Driveshaft bushing (2)
0566 Plug, pipe-hex socket (2, one for each cover)
0125 Cover, rear
0627 Hex washer head screw (20, for both covers)

How to Order Replacement Parts

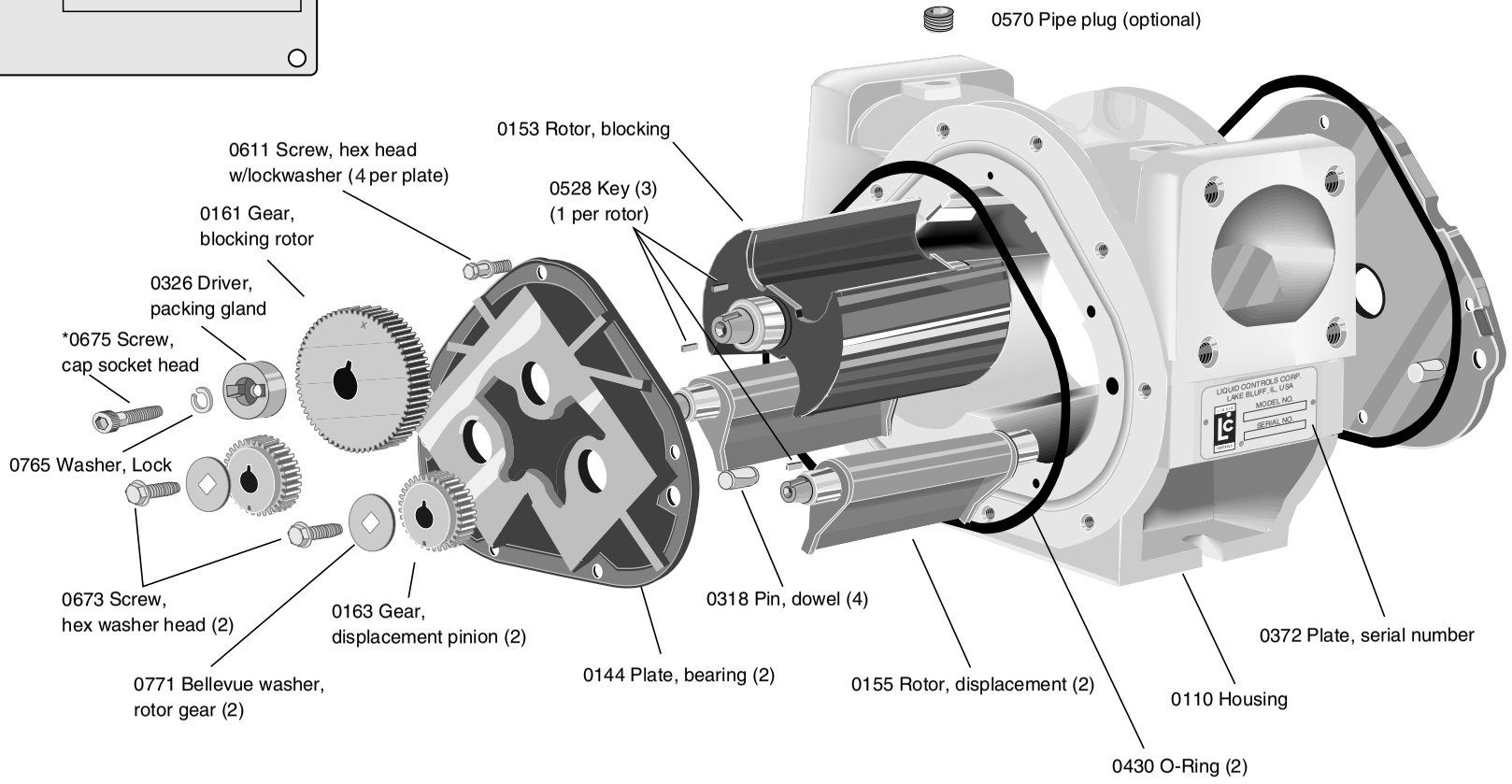
1. Find the item number listed on the exploded drawing. The 4 digit item numbers are listed with a word description.
2. Find the computer printout titled Parts List that has been inserted in this manual. Look up the item number on the Parts List. The Parts List shows each item number with a corresponding part number. Find the corresponding 5 digit part number for the item you want to order. The part number represents an individual piece, a kit or a complete assembly.
3. Inform your distributor of the part number that you need. The part number is the only number that allows the distributor to find the correct component for your meter.

Exploded View: M-7/MA-7/M-10 Meter Housing



When placing order for replacement parts please reference the meter's serial number.

Front cover ← → Rear cover


0570 Pipe plug (optional)
0153 Rotor, blocking
0611 Screw, hex head w/lockwasher (4 per plate)
0528 Key (3) (1 per rotor)
0161 Gear, blocking rotor
0326 Driver, packing gland
*0675 Screw, cap socket head
0765 Washer, Lock
0673 Screw, hex washer head (2)
0771 Bellevue washer, rotor gear (2)
0163 Gear, displacement pinion (2)
0144 Plate, bearing (2)
0318 Pin, dowel (4)
0155 Rotor, displacement (2)
0430 O-Ring (2)
0110 Housing
0372 Plate, serial number

*For M-10 Meter Blocking Rotor, #0672 Shown HereReplaces #0675

0672 Screw, blocking rotor

OWNERS MANUAL PARTS LIST - M7A1-LP

	ITEM	PART#	DESCRIPTION		QTY
COMPONENT		L2102	METER ELEMENT	M-7-1 FOR FORK DRIVE	1
	0678	00306	SCREW, DRV #2 x 0.19	TYPE 'U'	2
	0611	09079	SCREW, #10-24 X 0.625	HX HD, SEMS, SS	10
	0765	06174	LOCK WASHER, 0.250	HVY HLCL SPR, 18-8 SS	1
	0318	40665	PIN, DOWEL	0.250 DIA X 0.625 LOND	4
	0675	07483	SCREW, 1/4-20 X 1.00	HEX SCKT HD CAP, 316SS	1
	0144	41804	PLATE, BEARING NI-RESIST	SV-1-2-3-7-14	2
	0161	47646	GEAR, BLOCKING ROTOR	GEAR BLKG RTR M7	1
	0163	47647	GEAR, PINION	PINION GEAR	2
	0153	48306	BLOCKING ROTOR ASSY M7	ALUM / 316 SST-HC	1
	0528	48332	KEY, ROTOR GEAR M7	0.12 X 0.15 X 0.5 316 SST	3
	0771	48348	WASHER, ROTOR GEAR	0.25 ID, 1.0 OD, 301 SS	2
	0155	48366	DISPLACEMENT ROTOR ASSY	M7 ALUM / 316 SST-HC	2
	0200	48496	MANUAL, M7 / MA7 / M10	METER (LC-158)	1
	0326	48756	DRIVER, PACKING GLAND	M15 METERS	1
	0372	49444	NAMEPLATE, METER HOUSING	SERIAL NUMBER	1
	0110	49445	HOUSING, M7 METER	ALUMINUM NEW STYLE	1
	0673	09027	SCREW, 1/4-20 X 0.75 L	HX HDEAD CAP, 18-8 SS	2
COMPONENT		25214	COVER ASSY M5	ALUM COVERS, NEW STYLE	1
	0566	06790	PIPE PLUG, 0.250-18 NPT	HEX SCKT HD, 302 SS	2
	0627	09080	SCREW, 0.312-18 X 1.375	HEX WSHR HD, THD FRMG	20
	0123	48301	COVER, FRONT M7	DIE CAST ALUM	1
	0125	48302	COVER, REAR M7	DIE CAST ALUM	1
COMPONENT		25227	SEAL KIT	M7 UL BUNA AL / CI / BRASS	1
	0430	09578	O-RING, 6.25" ID BUNA, UL	6.4375 OD X 0.093 THK (SQR)	2
COMPONENT		A2210	FLANGE ASSY, M5 & M7	ALUM / BUNA / 2" NPT	2
	0750	04498	FLAT WASHER, 0.406 ID	0.812 OD X 0.062 THK	8
	0420	06854	O-RING, 2.88" ID BUNA-N UL	3.12 OD X 0.12 DIA WALL	2
	0135	48394	FLANGE, COMP; 2" NPT	ALUM, O-RING STYLE	2
	0620	06851	SCREW, 3/8-16 X 1.500	HEX HD CAP, GR 8	8

Hannay Reels®
The reel leader.

INSTALLATION INSTRUCTIONS

Electric Rewind Reels for DC and AC Operation

Hannay Reels, 553 State Route 143, Westerlo, NY USA 12193-0159 www.hannay.com E-mail: reels@hannay.com
PHONE: 518-797-3791 **TOLL FREE:** 1-877-GO-REELS (467-3357)
FAX: 1-800-REELING (733-5464) **INT'L FAX:** (518) 797-3259

NOTE: FAILURE TO FOLLOW THESE INSTRUCTIONS MAY VOID THE WARRANTY.

Unpacking and mounting the reel

1. Inspect the reel for shipping damage.
2. Check the wiring kit against the parts list.
3. Fasten the reel frame securely to a level surface.
4. Turn the reel discs by hand. The spool should turn freely. If it binds, adjust the self-aligning bearings.

Connecting the inlet

1. Threaded-type swivel joint inlets must be connected to the fluid supply by a **flexible connector** or the Hannay Warranty will be void.
2. Victaulic-type inlet connections must be carefully aligned. Two victaulic connections, correctly installed, will normally allow adequate flexibility for smooth rotation.
3. Install a union fitting as near as possible to the swivel joint so the joint can be easily removed for servicing.

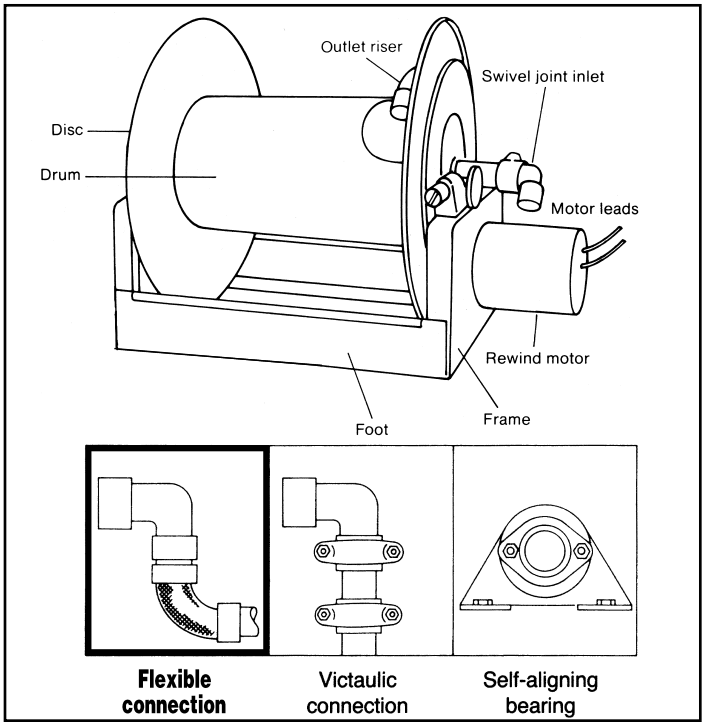
Wiring the reel

1. Certain accessories have been provided to wire your reel (see following pages). You will, however, need to provide a few additional materials:
   - Insulated Cable, #6 AWG (or larger, see note)
   - Various Insulated Ring Terminal and Wire Nut Connectors (installation specific)
   - Circuit Breaker (see chart for amperage ratings)
   - Ground Strap for Reel
   - Vapor-proof Conduit (optional)
2. Follow the appropriate wiring diagram on the following pages to make the necessary connections. Check all ground connections before using motor.
   NOTE: #6 AWG wire should be sufficient in most installations to prevent significant voltage drop. However, you may choose to use heavier #4 AWG if the total circuit length is unusually long.
3. The solenoid (12 or 24 V only) should be mounted as close as possible to the battery and/or starter. It should be mounted vertically and grounded securely. A circuit breaker MUST be wired into the circuit between the solenoid and battery.
4. The motor rotation can be reversed by interchanging the motor leads.
5. If you choose to use vapor-proof conduit between the solenoid and motor, then seal the open end of the conduit with a sealing compound and wrap with electrical tape.
6. A ground strap must be securely fastened between the reel frame and a grounded part of the vehicle body. The motor ground lead must be directly bonded to the chassis. Do NOT rely on the reel structure for grounding. For explosion proof applications, the ground lead must be run to, and bonded to, the chassis in a non hazardous location such as the engine compartment of the vehicle.
7. Tape all connections and check each one to make sure they are secure.

Connecting the hose

1. Do NOT attach the hose until the reel has been installed and wired.
2. Charge the hose *before* winding it on the reel. This will protect the drum from excessive pressure.
3. *If reel has flanged outlet riser:* Remove the entire riser from the hub. Be careful not to damage the gasket. Apply thread compound to all threads and bushings. Thread the hose onto the outlet riser. Replace the riser and tighten securely, making sure the gasket is seated properly.
   If reel does NOT have flanged riser: The riser can't be removed, so you will need to thread the hose directly onto the riser.
4. Wind the hose onto the reel (either electrically or with the hand crank).

NOTE: Hannay Reels electric rewind motors are designed to be operated by repeatedly pressing and releasing the rewind switch thus controlling the rewind speed of the reel.



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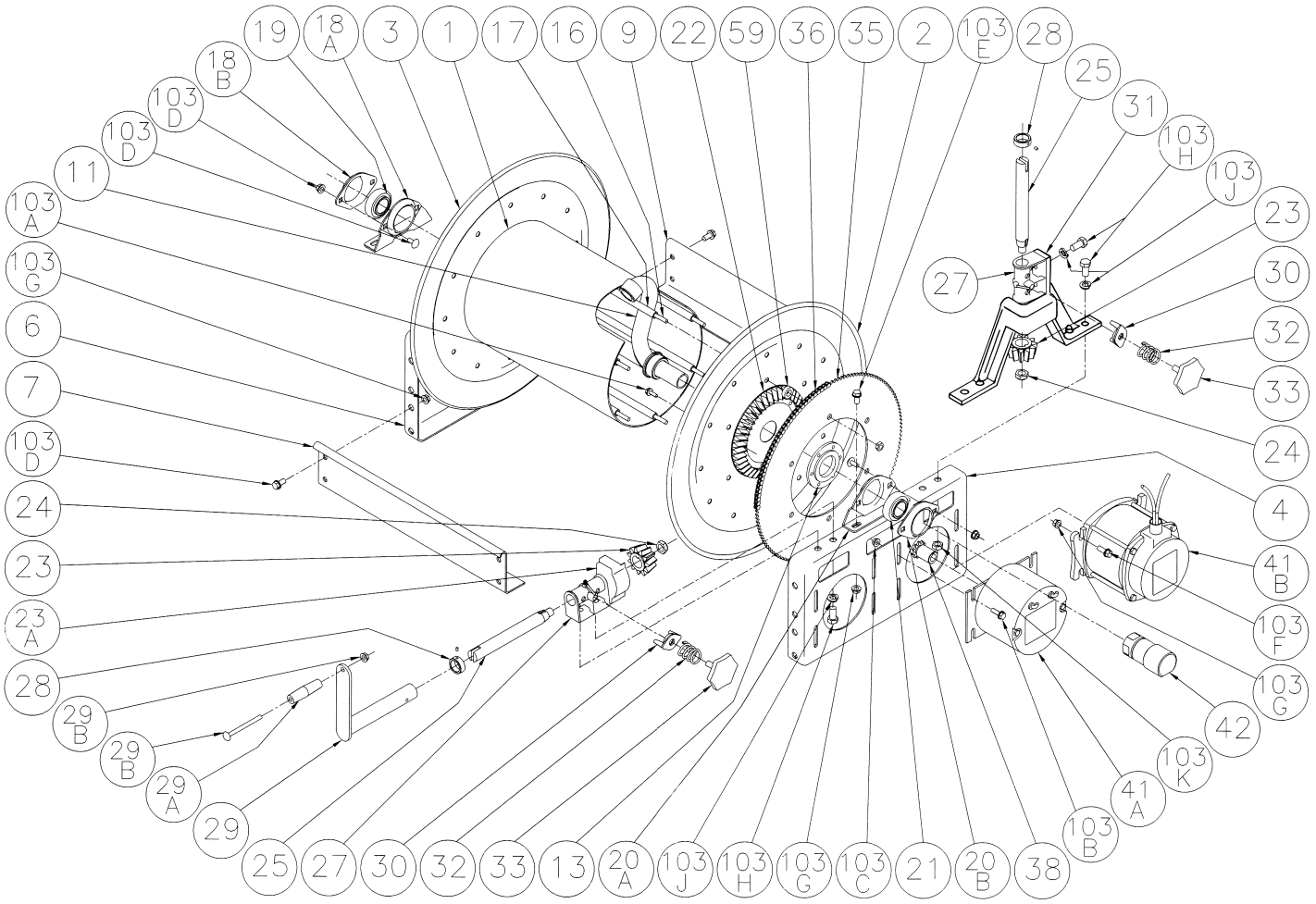
Website: www.hannay.com
E-mail: reels@hannay.com

ISO 84

PARTS LIST

1˝ HOSE REEL



PARTS LIST
ISO 84
1″ Hose Reels

When ordering parts

BE SURE TO SPECIFY COMPLETE MODEL NUMBER and SERIAL NUMBER OF REEL.

USE PART NUMBER!

Item No.	Description	PART NUMBER	Quantity
1	Drum, 10-1/2″ Diameter .....(Specify Model)	9905.3131	1
2	Front Disc, 19-20 Series .....(Specify Model)	9903.0821	1
2	Front Disc, 21-22 Series .....(Specify Model)	9903.0921	1
2	Front Disc, 22-23 Series .....(Specify Model)	9903.1021	1
2	Front Disc, 23-24 Series .....(Specify Model)	9903.1121	1
2	Front Disc, 25-26 Series .....(Specify Model)	9903.1321	1
2	Front Disc, 26-27 Series .....(Specify Model)	9903.1421	1
2	Front Disc, 28-29 Series .....(Specify Model)	9903.1521	1
2	Front Disc, 30-31 Series .....(Specify Model)	9903.1621	1
3	Back Disc, 19-20 Series.....(Specify Model)	9903.0821	1
3	Back Disc, 21-22 Series.....(Specify Model)	9903.0921	1
3	Back Disc, 22-23 Series.....(Specify Model)	9903.1021	1
3	Back Disc, 23-24 Series.....(Specify Model)	9903.1121	1
3	Back Disc, 25-26 Series.....(Specify Model)	9903.1321	1
3	Back Disc, 26-27 Series.....(Specify Model)	9903.1421	1
3	Back Disc, 28-29 Series.....(Specify Model)	9903.1521	1
3	Back Disc, 30-31 Series.....(Specify Model)	9903.1621	1
4	Front Frame (Up to 23-24)	9906.0003	1
4	Front Frame (Up to 30-31)	9906.5031	1
6	Back Frame (Up to 23-24)	9906.0003	1
6	Back Frame (Up to 30-31)	9906.5031	1
7	Front Foot.....(Specify Model)	9907.3000	1
9	Back Foot .....(Specify Model)	9907.3000	1
11	Hub Assembly, w/1″ FNPT Riser.....(Specify Model)	9901.1600	1
13	EH-936 Washer.....	9965.0015	2
16	3/8″-16 Carriage Bolt w/Nut.....	Specify Model	6
17	3/8″ Spacer Pipe .....(Specify Model)	9904.3200	6
18	Back Bearing Complete	9902.1400	1
18A	Self-Aligning Pillow Block, Back.....	9902.2900	1
18B	Self-Aligning Bearing Holder, Back	9902.2800	1
19	Back Bearing Insert Only	9902.1500	1
20	Front Bearing Complete.....	9902.1400	1
20A	Self-Aligning Pillow Block, Front	9902.2900	1
20B	Self-Aligning Bearing Holder, Front.....	9902.2800	1
21	Front Bearing Insert Only.....	9902.1500	1
22	Ring Gear, H-26 (Up to 25-26).....	9914.0372	1
22	Ring Gear, H-28	9914.0382	1
23	Pinion Gear, H-27 (Up to 25-26)	9914.0393	1
23	Pinion Gear, H-29.....	9914.0403	1
23A	Gear Guard	9914.0618	1
24	5/8″-18 SAE Hex Nut (ESNA)	9904.5600	1
25	Pinion Shaft.....(Specify Model)	9914.0250	1
27	Side Pinion Bearing.....	9914.0243	1
28	Collar & Set Screw.....	9914.0351	1
29	Crank Handle, H-18 Complete.....	9914.0011	1
29A	Hand Crank Handle.....	9914.0506	1
29B	Hand Crank Handle Bolt w/Nut	9914.0511	1
30	Brake Pad, H-3.....	9914.0433	1
31	Vertical Rewind Bracket	9914.0233	1
32	Brake Spring, H-31.....	9914.0451	1
33	Brake Wheel.....	9914.0413	1
35	112T35 Disc Sprocket	9910.1321	1
35	138T35 Disc Sprocket.....	9910.1423	1
35	180T35 Disc Sprocket.....	9910.1526	1
36	Chain, #35.....	Specify Model	1
38	Motor Sprocket, 11T35 x 1-5/16.....	9910.1118	1
41A	Motor, 12 Volt Nonexplosion-Proof.....	9915.0042	1
41B	Motor, 12 Volt Explosion-Proof.....	9915.0003	1
42A	Swivel Joint, Super Swivel, 1″ FxF.....	9929.8551	1
42B	Swivel Joint, Full Circle, 1” FxF.....	9929.0501	1
59	Sprocket Spacer.....	9954.0017	6
103A	5/16″-18 x 1/2″ Spinlock Bolt.....	9904.2158	5
103B	5/16″-18 x 1″ Spinlock Bolt.....	9904.2102	4
103C	5/16″-18 Spinlock Nut.....	9904.6100	4
103D	3/8″-16 x 3/4″ Carriage Bolt w/Nut	9904.0201	4
103E	3/8″-16 x 3/4″ Spinlock Bolt.....	9904.2201	12
103F	3/8″-16 x 1″ Spinlock Bolt.....	9904.2202	4
103G	3/8″-16 Spinlock Nut.....	9904.6200	16
103H	1/2″-13 x 1″ Hex Head Bolt	9904.1402	6
103J	1/2″ Lock Washer	9954.0030	6
103K	1/2″-13 Hex Nut.....	9904.5400	4

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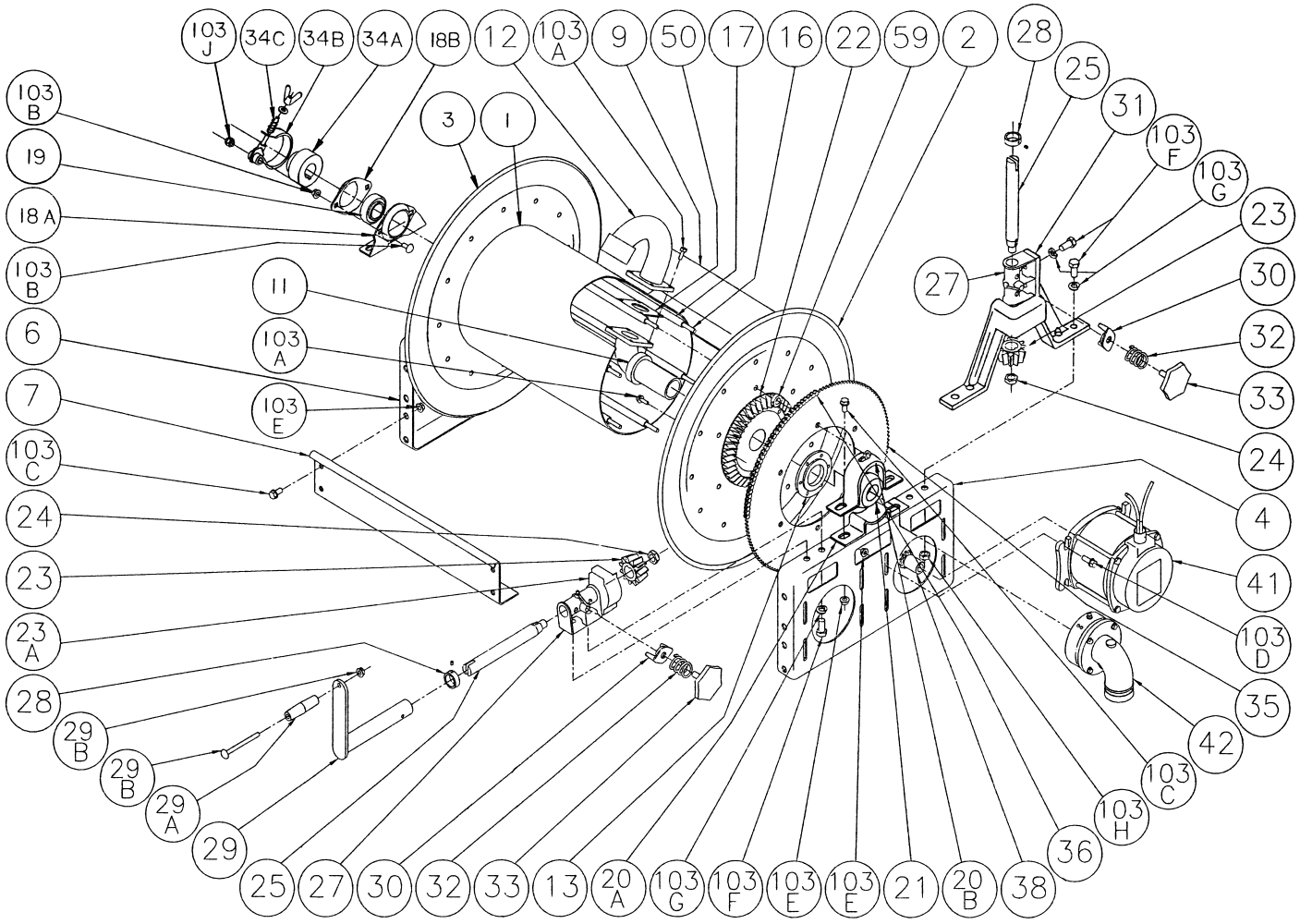
INT'L FAX (518) 797-3259
Website: www.hannay.com
E-mail: reels@hannay.com

ISO 18

PARTS LIST

1 1/2" HOSE REELS
With Tube Turn Internals & Ball Bearing Swivel Joints



Hannay ISO Parts Lists are available at www.hannay.com

PARTS LIST
ISO-18
1 1/2" Hose Reel

When ordering parts

BE SURE TO SPECIFY COMPLETE MODEL NUMBER and SERIAL NUMBER OF REEL.

USE PART NUMBER!

Item No.	Description	PART NUMBER	Quantity
1	Drum, 10-1/2" Diameter (Specify Model)	9905.3131	1
2	Front Disc, 19-20 Series	9903.0821	1
2	Front Disc, 23-24 Series	9903.1121	1
2	Front Disc, 25-26 Series	9903.1321	1
2	Front Disc, 26-27 Series	9903.1421	1
2	Front Disc, 28-29 Series	9903.1521	1
2	Front Disc, 30-31 Series	9903.1621	1
3	Back Disc, 19-20 Series	9903.0821	1
3	Back Disc, 23-24 Series	9903.1121	1
3	Back Disc, 25-26 Series	9903.1321	1
3	Back Disc, 26-27 Series	9903.1421	1
3	Back Disc, 28-29 Series	9903.1521	1
3	Back Disc, 30-31 Series	9903.1621	1
4	Front Frame (Up to 23-24)	9906.0031	1
4	Front Frame (Up to 30-31)	9906.5031	1
6	Back Frame (Up to 23-24)	9906.0031	1
6	Back Frame (Up to 30-31)	9906.5031	1
7	Front Foot (Specify Model)	9907.3000	1
9	Back Foot (Specify Model)	9907.3000	1
11	1-1/2" Flange Hub Only (Specify Model)	9901.3640	1
12	1-1/2" FNPT Iron Pipe Riser Only	9901.3760	1
13	EH-936 Washer	9965.0015	2
16	3/8"-16 Carriage Bolt w/Nut	Specify Model	6
17	3/8" Spacer Pipes (Specify Model)	9904.3200	6
18	Back Bearing Complete	9902.1400	1
18A	Self-Aligning Pillow Block, Back	9902.2900	1
18B	Self-Aligning Bearing Holder, Back	9902.2800	1
19	Back Bearing Insert Only	9902.1500	1
20	Front Bearing Complete	9902.1610	1
20A	Bearing Holder (Bottom Strap), Front	9902.2950	1
20B	Bearing Holder (Top Strap), Front	9902.2955	1
21	Front Bearing Insert Only (With Grease Fitting)	9902.1700	1
22	Ring Gear, H-26 (Up to 25-26)	9914.0372	1
22	Ring Gear, H-28	9914.0382	1
23	Pinion Gear, H-27 (Up to 25-26)	9914.0393	1
23	Pinion Gear, H-29	9914.0403	1
23A	Gear Guard	9914.0618	1
24	5/8"-18 SAE Hex Nut (ESNA)	9904.5600	1
25	Pinion Shaft (Specify Model)	9914.0250	1
27	Side Pinion Bearing	9914.0243	1
28	Collar & Set Screw	9914.0351	1
29	Crank Handle, H-18 Complete	9914.0011	1
29A	Hand Crank Handle	9914.0506	1
29B	Hand Crank Handle Bolt w/Nut	9914.0511	1
30	Brake Pad, H-3	9914.0433	1
31	Vertical Rewind Bracket	9914.0233	1
32	Brake Spring, H-31	9914.0451	1
33	Brake Wheel	9914.0413	1
34A	Comet Brake Hub	9947.0038	1
34B	Comet Brake Strap only	9947.0091	1
34C	Comet Brake Tention Adjuster (Bolt,Spring,Washer,Wing Nut)	9947.0092	1
35	112T35 Disc Sprocket	9910.1321	1
35	138T35 Disc Sprocket	9910.1423	1
35	180T35 Disc Sprocket	9910.1526	1
36	Chain, #35	Specify Model	1
38	Motor Sprocket, 11T35 x 1-5/16	9910.1118	1
41	Motor, 12 Volt Explosion-Proof	9915.0003	1
42	1-1/2" 90 Deg. FxF Swivel Joint (STANDARD; Not for LPG)	9930.4210	1
42	1-1/2" 90 Deg. FxF Swivel Joint (for LP GAS Applications)	9930.0531	1
50	Gasket	9965.0021	1
59	Sprocket Spacer	9954.0017	6
103A	5/16"-18 x 1/2" Hex Head Bolt	9904.1101	9
103B	3/8"-16 x 3/4" Carriage Bolt w/Nut (w/o Comet Brake)	9904.0201	2
103B	3/8"-16 x 2" Carriage Bolt w/Nut (w/Comet Brake)	9947.0093	1
103C	3/8"-16 x 3/4" Spinlock Bolt	9904.2201	12
103D	3/8"-16 x 1" Spinlock Bolt	9904.2202	4
103E	3/8"-16 Spinlock Nut	9904.6200	16
103F	1/2"-13 x 1" Hex Head Bolt	9904.1402	6
103G	1/2" Lock Washer	9954.0030	6
103H	1/2"-13 Hex Nut	9904.5400	4
103J	3/8"-16 ESNA Nut	9904.5201	1

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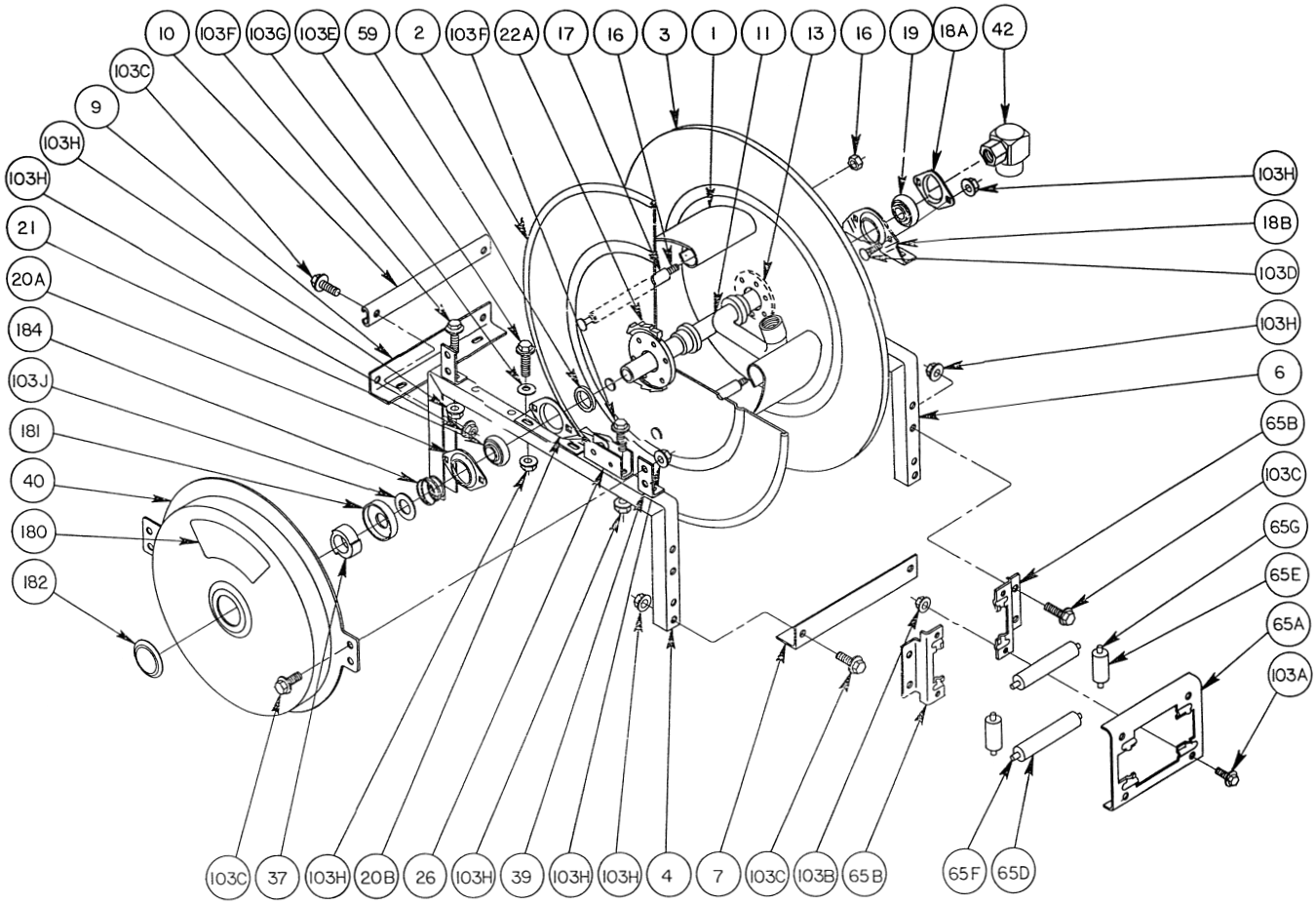
ISO 42
PARTS LIST
SERIES 800



PARTS LIST
ISO-42
SERIES 800

When ordering parts

BE SURE TO SPECIFY COMPLETE MODEL NUMBER and SERIAL NUMBER OF REEL.

USE PART NUMBER!

Item No.	Description	PART NUMBER	Quantity
1	Drum, 10-1/2" Dia. - Wrap Around (Specify Model)	9905.0138	1
1	Drum, 15-1/2" Dia. - Wrap Around (Specify Model)	9905.0178	1
2	Front Disc, 19-20, 18-3/4" Dia. (Specify Model)	9903.0821	1
2	Front Disc, 23-24, 21-3/4" Dia. (Specify Model)	9903.1121	1
2	Front Disc, 25-26, 24-3/4" Dia. (Specify Model)	9903.1321	1
2	Front Disc, 28-29, 26-3/4" Dia. (Specify Model)	9903.1521	1
2	Front Disc, 30-31, 28-3/4" Dia. (Specify Model)	9903.1621	1
3	Back Disc, 19-20, 18-3/4" Dia. (Specify Model)	9903.0821	1
3	Back Disc, 23-24, 21-3/4" Dia. (Specify Model)	9903.1121	1

PARTS LIST
ISO-42
SERIES 800

When ordering parts

BE SURE TO SPECIFY COMPLETE MODEL NUMBER and SERIAL NUMBER OF REEL.

USE PART NUMBER!

Item No.	Description	PART NUMBER	Quantity
3	Back Disc, 25-26, 24-3/4" Dia. (Specify Model)	9903.1321	1
3	Back Disc, 28-29, 26-3/4" Dia. (Specify Model)	9903.1521	1
3	Back Disc, 30-31, 28-3/4" Dia. (Specify Model)	9903.1621	1
4	Front Frame, 19-20, 1-1/2" Rollform Channel	9906.0081	1
4	Front Frame, 23-24, 1-1/2" Rollform Channel	9906.0111	1
4	Front Frame, 25-26, 1-1/2" Rollform Channel	9906.0121	1
4	Front Frame, 28-29, 1-1/2" Rollform Channel	9906.0141	1
4	Front Frame, 30-31, 1-1/2" Rollform Channel	9906.0151	1
6	Back Frame, 19-20, 1-1/2" Rollform Channel	9906.0081	1
6	Back Frame, 23-24, 1-1/2" Rollform Channel	9906.0111	1
6	Back Frame, 25-26, 1-1/2" Rollform Channel	9906.0121	1
6	Back Frame, 28-29, 1-1/2" Rollform Channel	9906.0141	1
6	Back Frame, 30-31, 1-1/2" Rollform Channel	9906.0151	1
7	Front Foot	Specify Model	1
9	Back Foot	Specify Model	1
10	Back Brace - C Channel	Specify Model	1
11	1" Hub Assembly, Welded Iron Pipe w/1" FNPT Riser (Specify Model)	9901.1600	1
13	Disc Washer w/Rivets, EH-936	9965.0015	1
16	3/8" - 16 Carriage Bolt w/Nut (10-1/2" Drum)	Specify Model	6
16	3/8" - 16 Carriage Bolt w/Nut (15-1/2" Drum)	Specify Model	10
17	Spacer Pipe (10-1/2" Drum)	Specify Model	6
17	Spacer Pipe (15-1/2" Drum)	Specify Model	10
18A	Self Aligning Bearing Holder (Back)	9902.2800	1
18B	Self-Aligning Bearing Pillow Block (Back)	9902.2900	1
19	Self-Aligning Bearing Insert (Back)	9902.1500	1
20A	Self-Aligning Bearing Holder (Front)	9902.2800	1
20B	Self-Aligning Bearing Pillow Block (Front)	9902.2900	1
21	Self-Aligning Bearing Insert (Front)	9902.1500	1
22A	Ratchet Wheel	9922.0015	1
26	Ratchet Locking Assembly, GH-784	9922.0005	1
37	Spring Arbor For A & D Spring	9922.0001	1
37	Spring Arbor For B, G, & J Spring	9922.0002	1
39	Spring Mounting Bracket	9922.0009	2
40	Spring Motor, A	9921.0010	1
40	Spring Motor, B	9921.0015	1
40	Spring Motor, D	9921.0020	1
40	Spring Motor, G	9921.0021	1
40	Spring Motor, J	9921.0030	1
42	1" 90 Deg. FxF B.P. Swivel Joint	9929.8538	1
59	Hub Spacer	9954.0021	2
65A	Roller Bracket Frame, GH-895	Specify Model	1
65B	Roller Mounting Bracket, GH-896	9940.0170	1
65D	1" Dia Roller for Stamped Housing, GH-1012	Specify Model	2
65E	1" Dia. Roller for Stamped Housing, 2" Long, GH-1012A	9940.0180	2
65F	1/4" Dia. Stainless Steel Rod	Specify Model	2
65G	1/4" Dia. Stainless Steel Rod, 2-3/4" Long	9940.0190	2
66	EH-678D Roller Assembly (Not Shown)	9939.0009	1
103A	5/16" - 18 x 3/4" Spinlock Bolt	9904.2101	4
103B	5/16" - 18 Spinlock Nut	9904.6100	4
103C	3/8" - 16 x 3/4" Spinlock Bolt	9904.2201	14
103D	3/8" - 16 x 3/4" Carriage Bolt	9904.0201	4
103E	3/8" - 16 x 1-1/4" Spinlock Bolt	9904.2203	4
103F	3/8" - 16 x 1-1/2" Spinlock Bolt	9904.2204	4
103G	3/8" Flat Washer	9954.0007	4
103H	3/8" - 16 Spinlock Nut	9904.6200	22
103J	1-7/8" O.D. x 1-5/16" I.D. x .049 Washer	9954.0019	1
180	Caution Decal, "Spring Under Tension"	9922.0010	1
181	Cap-Plug for Spring (Inner Side)	9922.0036	1
182	Cap-Plug for Spring (Outer Side)	9922.0037	1
184	Dust Cap Spring	9922.0038	1

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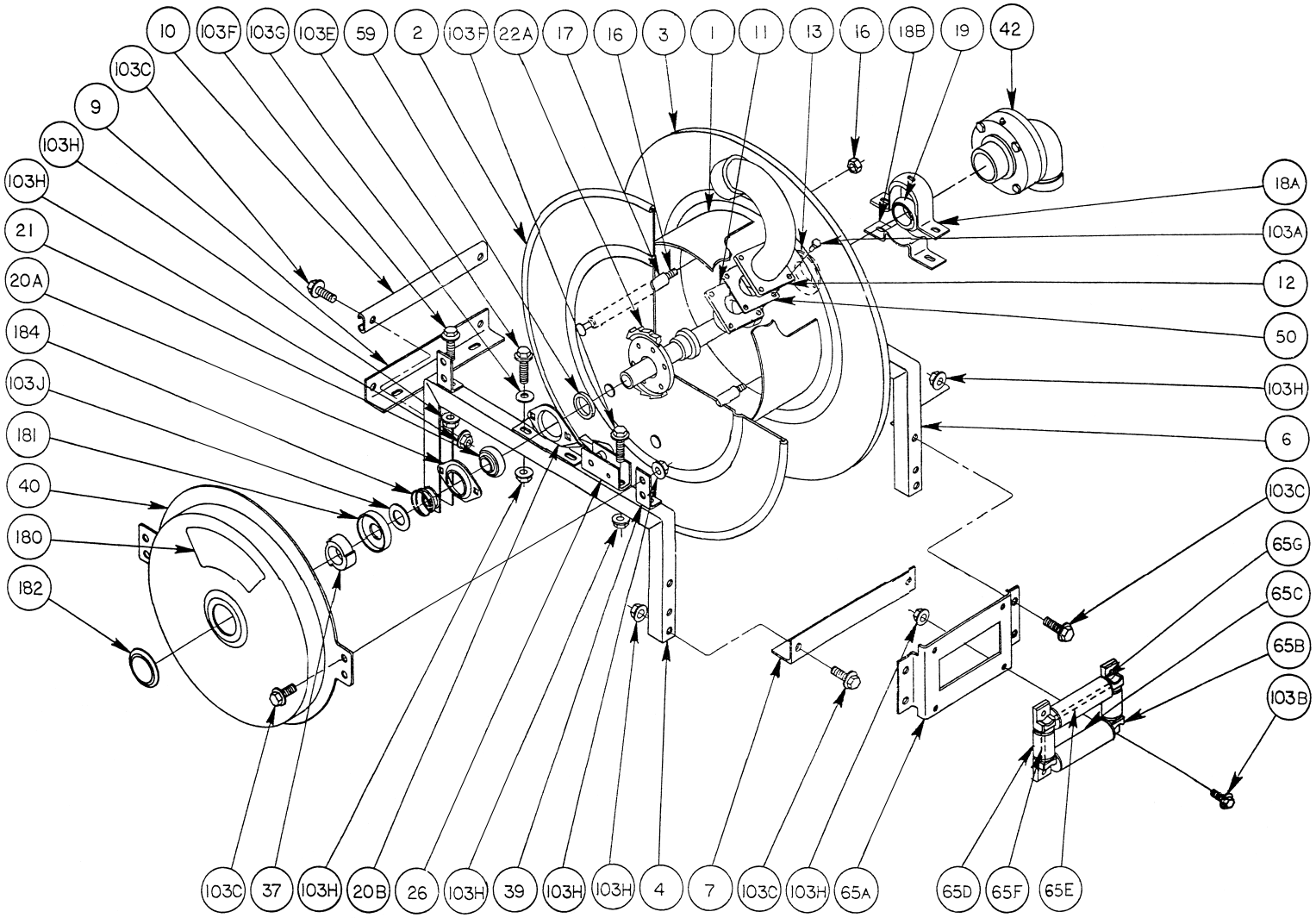
ISO 29

PARTS LIST

SERIES 900



Hannay ISO Parts Lists are available at www.hannay.com

PARTS LIST
ISO 29
Series 900

When ordering parts

BE SURE TO SPECIFY COMPLETE MODEL NUMBER and SERIAL NUMBER OF REEL.

USE PART NUMBER!

Item No.	Description	PART NUMBER	Quantity
1	Drum, 10-1/2" Dia. (Specify Model)	9905.3131	1
2	Front Disc, 23-24, 21-3/4" Dia. (Specify Model)	9903.1121	1
2	Front Disc, 25-26, 24-3/4" Dia. (Specify Model)	9903.1321	1
2	Front Disc, 28-29, 26-3/4" Dia. (Specify Model)	9903.1521	1
2	Front Disc, 30-31, 28-3/4" Dia. (Specify Model)	9903.1621	1
3	Back Disc, 23-24, 21-3/4" Dia. (Specify Model)	9903.1121	1
3	Back Disc, 25-26, 24-3/4" Dia. (Specify Model)	9903.1321	1
3	Back Disc, 28-29, 26-3/4" Dia. (Specify Model)	9903.1521	1
3	Back Disc, 30-31, 28-3/4" Dia. (Specify Model)	9903.1621	1
4	Front Frame, 23-24	9906.0111	1
4	Front Frame, 25-26	9906.0121	1
4	Front Frame, 28-29	9906.0141	1
4	Front Frame, 30-31	9906.0151	1
6	Back Frame, 23-24	9906.0111	1
6	Back Frame, 25-26	9906.0121	1
6	Back Frame, 28-29	9906.0141	1
6	Back Frame, 30-31	9906.0151	1
7	Front Foot (Specify Model)	9907.2000	1
9	Back Foot (Specify Model)	9907.2000	1
10	Back Brace - C Channel (Specify Model)	9907.7000	1
11	1-1/2" Flanged Hub (Specify Model)	9901.3640	1
12	1-1/2" FNPT Flanged Riser	9901.3760	1
13	Disc Washer w/Rivets, EH-936	9965.0015	1
16	3/8" - 16 Carriage Bolt w/Nut	(Specify Model)	6
17	Spacer Pipe (Specify Model)	9904.3200	6
18A	Greasable Bearing Holder (Top Strap)	9902.2955	1
18B	Greasable Bearing Holder (Bottom Strap)	9902.2950	1
19	1-1/2" Bronze Bearing Insert (w/Grease Fitting)	9902.1710	1
20A	Self-Aligning Bearing Holder (Front)	9902.2800	1
20B	Self-Aligning Bearing Pillow Block (Front)	9902.2900	1
21	Self-Aligning Bearing Insert (Front)	9902.1500	1
22A	Ratchet Wheel	9922.0015	1
26	Ratchet Locking Assembly, GH-784	9922.0005	1
37	Spring Arbor For A Spring	9922.0001	1
37	Spring Arbor For B Spring	9922.0002	1
39	Spring Mounting Bracket	9922.0009	2
40	Spring Motor, A	9921.0010	1
40	Spring Motor, B	9921.0015	1
42	1-1/2" 90 Deg. FxF Swivel Joint	9930.4210	1
50	Gasket	9965.0021	1
59	Hub Spacer	9954.0021	2
65A	R300 Roller Mounting Frame (Specify Model)	A69A-00100-66	1
65B	Roller Mounting Block	9940.0075	4
65C	1-1/2" Stainless Steel Roller Tubing (Specify Length)	9940.0003	2
65D	1-1/2" Stainless Steel Roller Tubing (Specify Length)	9940.0003	2
65E	Roller Rod (Specify Length)	9940.0009	2
65F	Roller Rod (Specify Length)	9940.0009	2
65G	1-1/2" Trunion Bearing	9940.0007	8
103A	5/16" - 18 x 3/4" Hex Head Bolt	9904.1101	4
103B	3/8" - 16 X 1" Spinlock Bolt	9904.2202	4
103C	3/8" - 16 x 3/4" Spinlock Bolt	9904.2201	12
103D	3/8" - 16 x 3/4" Carriage Bolt	9904.0201	4
103E	3/8" - 16 x 1-1/4" Spinlock Bolt	9904.2203	4
103F	3/8" - 16 x 1-1/2" Spinlock Bolt	9904.2204	4
103G	3/8" Flat Washer	9954.0007	4
103H	3/8" - 16 Spinlock Nut	9904.6200	24
103J	1-7/8" O.D. x 1-5/16" I.D. x .049 Washer	9954.0019	1
180	Caution Decal, "Spring Under Tension"	9922.0010	1
181	Cap-Plug for Spring (Inner Side)	9922.0036	1
182	Cap-Plug for Spring (Outer Side)	9922.0037	1
184	Dust Cap Spring	9922.0038	1

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ISO 194

PARTS LIST

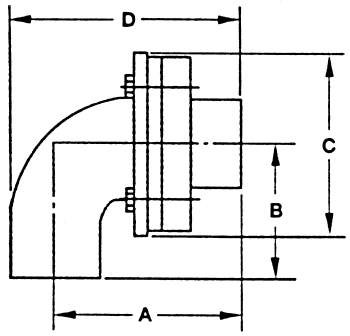
WHJ SERIES SWIVEL JOINT

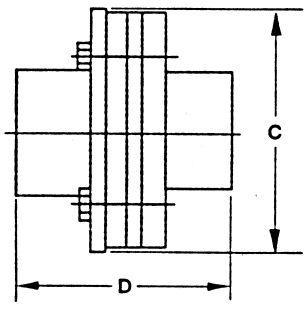
WHJ Series Ball-Bearing Swivel Joints for 1-1/2˝ & 2˝ Reels

APPROPRIATE APPLICATIONS: Liquid Fuels, Water
MATERIAL: Ductile Iron or Alum
RATING: 1000 psi (Ductile Iron), 600 PSI (Alum)
PACKING: Buna-N (standard); Viton (optional)

Changing the Packing (Refer to Diagram on Back): Remove any three of the four 5/16" x 1-1/4" cap screws *(item 12).* Loosen the remaining screw and pivot the packing ring *(item 2)* so that the packing *(item 5)* is exposed. Remove old packing and replace with new packing. Rotate packing ring back into place and reinstall three cap screws *(item 12)* and torque all cap screws to 100 lb-in. Caution: Before pivoting packing ring, be sure to clean joint of all dirt and debris which may fall into the joint and damage the seal.

Greasing the Joint: The frequency of greasing will, of course, vary according to usage of the reel, but generally speaking one pump with a manual grease gun every six months is more than sufficient. Do not overgrease this joint.



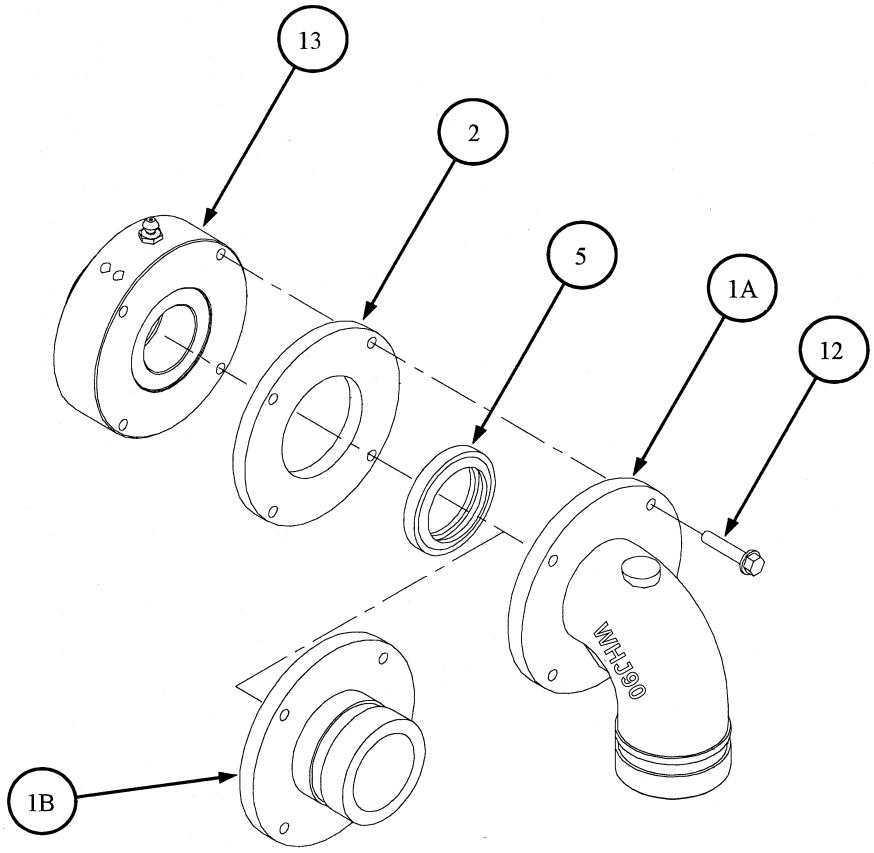


90° – STYLE 30

Model No.	Material	Thread at Reel End	Inlet	Dimensions (Inches) A	B	C	D
WHJ1590	Ductile Iron	1½" FPT	1½" FPT & 2" Groove	4 13/16"	3 3/8"	4 5/8"	6"
WHJ1590A	Aluminum	1½" FPT	1½" FPT & 2" Groove	4 13/16"	3 3/8"	4 5/8"	6"
WHJ290	Ductile Iron	2" FPT	1½" FPT & 2" Groove	5 1/4"	3 3/8"	4 5/8"	6 7/16"
WHJ2290	Ductile Iron	2" FPT	2" FPT & No Groove	5 1/4"	3 1/4"	4 5/8"	6 11/16"

STRAIGHT – STYLE 20

Model No.	Material	Thread at Reel End	Inlet	Dimensions (Inches) A	B	C	D
WHJ15180	Ductile Iron	1½" FPT	1½" FPT & 2" Groove			4 5/8"	4 3/16"
WHJ15180A	Aluminum	1½" FPT	1½" FPT & 2" Groove			4 5/8"	4 3/16"
WHJ2180	Ductile Iron	2" FPT	1½" FPT & 2" Groove			4 5/8"	4 3/16"
WHJ22180	Ductile Iron	2" FPT	2" FPT & No Groove			4 5/8"	4 3/16"



PARTS LIST
ISO-194
WHJ Ball Bearing Swivel Joints For 1-1/2" & 2˝ I.D. Reels

When ordering parts

BE SURE TO SPECIFY COMPLETE MODEL NUMBER and SERIAL NUMBER OF REEL.

USE PART NUMBER!

Drawing No.	Description	PART NUMBER	Quantity
ISO-194-1A	Inlet Fitting 90° 1-1/2" FIPT x 2˝ VICT	9938.0001	1
ISO-194-1A	Alum Inlet Fitting 90° 1 1/2" FIPT x 2˝ VICT	9938.0007	1
ISO-194-1A	Inlet Fitting 90° 2˝ FIPT	9938.0005	1
ISO-194-1B	Inlet Fitting 180° 1-1/2" FIPT x 2˝ VICT	9938.0004	1
ISO-194-1B	Alum Inlet Fitting 180° 1 1/2" FIPT x 2˝ VICT	9938.0002	1
ISO-194-1B	Inlet Fitting 180° 2˝ FIPT	9938.0006	1
ISO-194-2	P53A-00010 Packing Ring	call factory	1
ISO-194-5A	1-1/2" PK-1 Buna-N Pkg (CDI)	9936.0642	1
ISO-194-5B	1-1/2" PK-1V Viton Pkg	9936.0641	1
ISO-194-12	5/16"-18 x 1-1/4" Hex Head Capscrew	9904.1103	4
ISO-194-13A	WHJ Bearing Assembly (1-1/2")	9938.0030	1
ISO-194-13B	WHJ Bearing Assembly (1 1/2") Alum	9938.0031	1
ISO-194-13C	WHJ Bearing Assembly (2˝)	9938.0032	1

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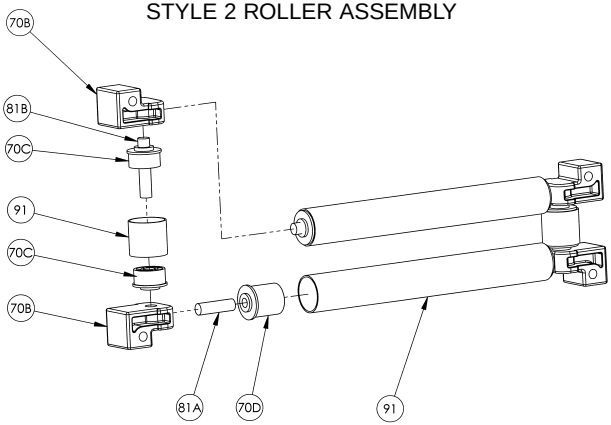
ISO 115

PARTS LIST

UTILITY HOSE ROLLERS

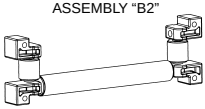
Assembly Styles A/B/C & A2/B2/C2

STYLE 2 ROLLER ASSEMBLY

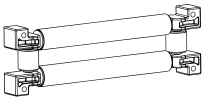


ASSEMBLY "A2"

ASSEMBLY "B2"



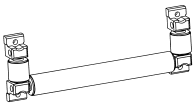
ASSEMBLY "C2"



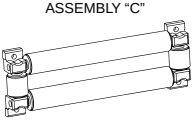
TRADITIONAL STYLE ROLLER ASSEMBLY

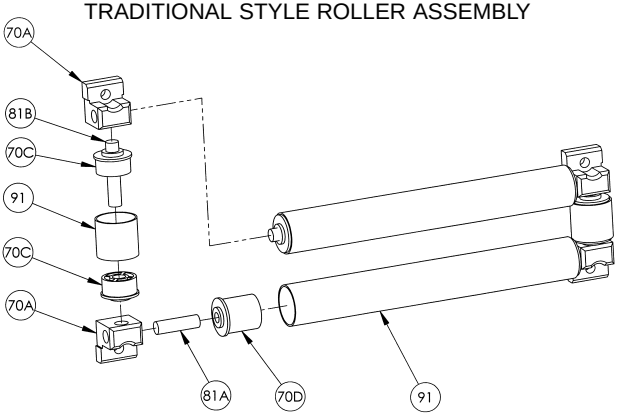
ASSEMBLY "A"

ASSEMBLY "B"



ASSEMBLY "C"





PARTS LIST
ISO 115
UTILITY HOSE ROLLERS
Assembly Styles A/B/C & A2/B2/C2

When ordering parts

BE SURE TO SPECIFY COMPLETE MODEL NUMBER and SERIAL NUMBER OF REEL.

USE PART NUMBER!

Item No.	Description	PART NUMBER
70A	EH-650 Mounting Block (Plated)	9940.0076
---	EH-650 Mounting Block (Unplated--NOT SHOWN)	9940.0075
70B	P70A-01450 Mounting Block (Composite)	9940.0078
70C	1-1/2˝ Trunnion Bearing (SHORT Style)	9940.0007
70D	1-1/2˝ Trunnion Bearing per P04A-00050 (LONG Style)	9940.0016
81A	1/2˝ SS Roller Rod, Specify Length	9940.0009
81B	1/2˝ x 1-1/2˝ SST Roller Rod	9940.0015
91	1-1/2” OD Stainless Steel Roller Tubing (Specify Length)	9940.0003
Assy. A	ASSY. “A” ROLLER COMPLETE (Specify Length)	9939.0060
Assy. B	ASSY. “B” ROLLER COMPLETE (Specify Length)	9939.0061
Assy. C	ASSY. “C” ROLLER COMPLETE (Specify Length).	9939.0062
Assy. A2	ASSY. “A2” ROLLER COMPLETE (Specify Length)	9939.1060
Assy. B2	ASSY. “B2” ROLLER COMPLETE (Specify Length)	9939.1061
Assy. C2	ASSY. “C2” ROLLER COMPLETE (Specify Length).	9939.1062

Installation & Maintenance Instructions

ASCO® Red-Hat II™

OPEN–FRAME, GENERAL PURPOSE, WATERTIGHT/EXPLOSIONPROOF SOLENOIDS

SERIES

8016G

Form No.V6583R7

—SERVICE NOTICE—

ASCO® solenoid valves with design change letter "G" in the catalog number (example: 8210G 1) have an epoxy encapsulated ASCO® Red Hat II™ solenoid. This solenoid replaces some of the solenoids with metal enclosures and open–frame constructions. Follow these installation and maintenance instructions if your valve or operator uses this solenoid.

DESCRIPTION

Catalog numbers 8016G1 and 8016G2 are epoxy encapsulated pull–type solenoids. The green solenoid with lead wires and 1/2″ conduit connection is designed to meet Enclosure Type 1–General Purpose, Type 2–Dripproof, Types 3 and 3S–Raintight, and Types 4 and 4X–Watertight. The black solenoid on catalog numbers prefixed "EF" is designed to meet Enclosure Types 3 and 3S–Raintight, Types 4 and 4X–Watertight, Types 6 and 6P–Submersible, Type 7 (A, B, C, & D) Explosionproof Class I, Division 1, Groups A, B, C, & D and Type 9 (E, F, & G)–Dust–Ignitionproof Class II, Division 1, Groups E, F, & G. The Class II, Groups F & G Dust Locations designation is not applicable for solenoids or solenoid valves used for steam service or when a class "H" solenoid is used. See *Temperature Limitations* section for solenoid identification and nameplate/retainer for service. When installed just as a solenoid and not attached to an ASCO valve, the core has a 0.250–28 UNF–2B tapped hole, 0.38 minimum full thread.

Series 8016G solenoids are available in:

- **Open–Frame Construction**
  The green solenoid may be supplied with 1/4″ spade, screw, or DIN terminals (Refer to Figure 4).
- **Panel Mounted Construction**
  These solenoids are specifically designed to be panel mounted by the customer through a panel having a .062 to .093 maximum wall thickness. (Refer to Figure 3 and section on *Installation of Panel Mounted Solenoid).*

Optional Features For Type 1 – General Purpose Construction Only

- **Junction Box**
  This junction box construction meets Enclosure Types 2,3,3S,4, and 4X. Only solenoids with 1/4″ spade or screw terminals may have a junction box. The junction box provides a 1/2″ conduit connection, grounding and spade or screw terminal connections within the junction box (See Figure 5).
- **DIN Plug Connector Kit No. K236034**
  Use this kit only for solenoids with DIN terminals. The DIN plug connector kit provides a two pole with grounding contact DIN Type 43650 construction (See Figure 6).

OPERATION

When the solenoid is energized, the core is drawn into the solenoid base sub–assembly. **IMPORTANT: When the solenoid is de–energized, the initial return force for the core, whether developed by spring, pressure, or weight, must exert a minimum force to overcome residual magnetism created by the solenoid. Minimum return force for AC construction is 11 ounces, and 4 ounces for DC construction.**

INSTALLATION

Check nameplate for correct catalog number, service, and wattage. Check front of solenoid for voltage and frequency.

⚠ WARNING: Electrical hazard from the accessibility of live parts. To prevent the possibility of death, serious injury or property damage, install the open – frame solenoid in an enclosure.

FOR BLACK ENCLOSURE TYPES 7 AND 9 ONLY

⚠ CAUTION: To prevent fire or explosion, do not install solenoid and/or valve where ignition temperature of hazardous atmosphere is less than 165° C. On valves used for steam service or when a class "H" solenoid is used, do not install in hazardous atmosphere where ignition temperature is less than 180°C. See nameplate/retainer for service.

NOTE: These solenoids have an internal non–resetable thermal fuse to limit solenoid temperature in the event that extraordinary conditions occur which could cause excessive temperatures. These conditions include high input voltage, a jammed core, excessive ambient temperature or a shorted solenoid, etc. This unique feature is a standard feature only in solenoids with black explosionproof/dust–ignitionproof enclosures (Types 7 & 9).

⚠ CAUTION: To protect the solenoid valve or operator, install a strainer or filter, suitable for the service involved in the inlet side as close to the valve or operator as possible. Clean periodically depending on service conditions. See ASCO Series 8600, 8601, and 8602 for strainers.

Temperature Limitations

For maximum valve ambient temperatures, refer to chart. The temperature limitations listed, only indicate maximum application temperatures for field wiring rated at 90°C. Check catalog number prefix and watt rating on nameplate to determine maximum ambient temperature. See valve installation and maintenance instructions for maximum fluid temperature.

NOTE: For steam service, refer to *Wiring* section, *Junction Box* for temperature rating of supply wires.

Temperature Limitations For Series 8016G Solenoids for use on Valves Rated at 6.1, 8.1, 9.1, 10.6, or 11.1 Watts

Watt Rating	Catalog Number Coil Prefix	Class of Insulation	Maximum † Ambient Temp.
6.1, 8.1, 9.1, & 11.1	None, FB, KF, KP, SF, SP, SC, & SD	F	125°F (51.7°C)
6.1, 8.1, 9.1, & 11.1	HB, HT, KB, KH, SS, ST, SU, & ST	H	140°F (60°C)
10.6	None, KF, SF, & SC	F	104°F (40°C)
10.6	HT, KH, SU, & ST	H	104°F (40°C)

†Minimum ambient temperature –40°F (–40° C).

Positioning

This solenoid is designed to perform properly when mounted in any position. However, for optimum life and performance, the solenoid should be mounted vertically and upright to reduce the possibility of foreign matter accumulating in the solenoid base sub–assembly area.

Wiring

Wiring must comply with local codes and the National Electrical Code. All solenoids supplied with lead wires are provided with a grounding wire which is green or green with yellow stripes and a 1/2″ conduit connection. To facilitate wiring, the solenoid may be rotated 360°. For the watertight and explosionproof solenoid, electrical fittings must be approved for use in the approved hazardous locations.

Additional Wiring Instructions For Optional Features:

- **Open–Frame solenoid with 1/4″ spade terminals**

For solenoids supplied with screw terminal connections use #12–18 AWG stranded copper wire rated at 90°C or greater. Torque terminal block screws to

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10 ± 2 in−lbs [1,0 ± 1,2 Nm]. A tapped hole is provided in the solenoid for grounding, use a #10−32 machine screw. Torque grounding screw to 15 −20 in−lbs [1,7 − 2,3 Nm]. On solenoids with screw terminals, the socket head screw holding the terminal block to the solenoid is the grounding screw. Torque the screw to 15 − 20 in−lbs [1,7 − 2,3 Nm]. with a 5/32″ hex key wrench.

- **Junction Box**

The junction box is used with spade or screw terminal solenoids only and is provided with a grounding screw and a 1/2″ conduit connection. Connect #12−18 AWG standard copper wire only to the screw terminals. Within the junction box use field wire that is rated 90°C or greater for connections. For steam service use 105°C rated wire up to 50 psi or use 125°C rated wire above 50 psi. After electrical hookup, replace cover gasket, cover, and screws. Tighten screws evenly in a crisscross manner.

- **DIN Plug Connector Kit No.K236−034**

1. The open−frame solenoid is provided with DIN terminals to accommodate the DIN plug connector kit.
2. Remove center screw from plug connector. Using a small screwdriver, pry terminal block from connector cover.
3. Use #12−18 AWG stranded copper wire rated at 90°C or greater for connections. Strip wire leads back approximately 1/4″for installation in socket terminals. The use of wire−end sleeves is also recommended for these socket terminals. Maximum length of wire−end sleeves to be approximately 1/4″. Tinning of the ends of the lead wires is not recommended.
4. Thread wire through gland nut, gland gasket, washer, and connector cover.

NOTE: Connector cover may be rotated in 90° increments from position shown for alternate positioning of cable entry.

5. Check DIN connector terminal block for electrical markings. Then make electrical hookup to terminal block according to markings on it. Snap terminal block into connector cover and install center screw.
6. Position connector gasket on solenoid and install plug connector. Torque center screw to 5 ± 1 in−lbs [0,6 ± 1,1 Nm].

NOTE: Alternating current (AC) and direct current (DC) solenoids are built differently. To convert from one to the other, it may be necessary to change the complete solenoid including the core and solenoid base sub−assembly, not just the solenoid. Consult ASCO.

Installation of Solenoid

Solenoids may be assembled as a complete unit. Tightening is accomplished by means of a hex flange at the base of the solenoid. The 3/4″ bonnet construction (Figure 1) must be disassembled for installation and installed with a special wrench adapter.

Installation of Panel Mounted Solenoid (See Figure 3)

Disassemble solenoid following instruction under *Solenoid Replacement* then proceed

3/4″ Valve Bonnet Construction

1. Install retainer (convex side to solenoid) in 1.312 diameter mounting hole in customer panel.
2. Then position spring washer over plugnut/core tube sub−assembly.
3. Install plugnut/core tube sub−assembly through retainer in customer panel. Then replace solenoid, nameplate/retainer and red cap.

15/16″ Valve Bonnet Construction

1. Install solenoid base sub−assembly through 0.69 diameter mounting hole in customer panel.
2. Position spring washer on opposite side of panel over solenoid base sub−assembly then replace.

Solenoid Temperature

Standard solenoids are designed for continuous duty service. When the solenoid is energized for a long period, the solenoid becomes hot and can be touched by hand only for an instant. This is a safe operating temperature.

MAINTENANCE

⚠ WARNING: To prevent the possibility of death, serious injury or property damage, turn off electrical power, depressurize solenoid operator and/or valve, and vent fluid to a safe area before servicing.

Cleaning

All solenoid operators and valves should be cleaned periodically. The time between cleaning will vary depending on medium and service conditions. In general, if the voltage to the solenoid is correct, sluggish valve operation, excessive noise or leakage will indicate that cleaning is required. Clean strainer or filter when cleaning the valve.

Preventive Maintenance

- Keep the medium flowing through the solenoid operator or valve as free from dirt and foreign material as possible.
- While in service, the solenoid operator or valve should be operated at least once a month to insure proper opening and closing.
- Depending on the medium and service conditions, periodic inspection of internal valve parts for damage or excessive wear is recommended. Thoroughly clean all parts. Replace any worn or damaged parts.

Causes of Improper Operation

- **Faulty Control Circuit:** Check the electrical system by energizing the solenoid. A metallic *click* signifies that the solenoid is operating. Absence of the *click* indicates loss of power supply. Check for loose or blown fuses, open−circuited or grounded solenoid, broken lead wires or splice connections.
- **Burned−Out Solenoid:** Check for open−circuited solenoid. Replace if necessary. Check supply voltage; it must be the same as specified on nameplate/retainer and marked on the solenoid. Check ambient temperature and check that the core is not jammed.
- **Low Voltage:** Check voltage across the solenoid leads. Voltage must be at least 85% of rated voltage.

Solenoid Replacement

1. On solenoids with lead wires disconnect conduit, coil leads, and grounding wire.

NOTE: Any optional parts attached to the old solenoid must be reinstalled on the new solenoid.

2. Disassemble solenoids with optional features as follows:

- **Spade or Screw Terminals**
  Remove terminal connections, grounding screw, grounding wire, and terminal block (screw terminal type only).

NOTE: For screw terminals, the socket head screw holding the terminal block serves as a grounding screw.

- **Junction Box**
  Remove conduit and socket head screw (use 5/32″ hex key wrench) from center of junction box. Disconnect junction box from solenoid.
- **DIN Plug Connector**
  Remove center screw from DIN plug connector. Disconnect DIN plug connector from adapter. Remove socket head screw (use 5/32″ hex key wrench), DIN terminal adapter, and gasket from solenoid.

3. Snap off red cap from top of solenoid base sub−assembly.
4. Push down on solenoid. Then using a suitable screwdriver, insert blade in slot provided between solenoid and nameplate/retainer. Pry up slightly and push to remove. Then remove solenoid from solenoid base sub−assembly.
5. Reassemble using exploded views for parts identification and placement

Disassembly and Reassembly of Solenoids

1. Remove solenoid, see *Solenoid Replacement*.
2. Remove finger washer or spring washer from solenoid base sub−assembly.
3. Unscrew solenoid base sub−assembly.

NOTE: Some solenoid constructions have a plugnut/core tube sub−assembly, bonnet gasket and bonnet in place of the solenoid base sub−assembly. To remove bonnet use special wrench adapter supplied in ASCO Rebuild Kit. For wrench adapter only, order ASCO Wrench Kit No.K218948.

4. The core is now accessible for cleaning or replacement.
5. If the solenoid is part of a valve, refer to basic valve installation and maintenance instructions for further disassembly.
6. Reassemble using exploded views for identification and placement of parts.

ORDERING INFORMATION FOR ASCO SOLENOIDS

When Ordering Solenoids for ASCO Solenoid Operators or Valves, order the number stamped on the solenoid. Also specify voltage and frequency.

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Torque Chart

Part Name	Torque Value in Inch—Pounds	Torque Value in Newton—Meters
solenoid base sub—assembly	175 ± 25	19,8± 2,8
valve bonnet (3/4″ bonnet construction)	90 ± 10	10,2 ± 1,1
bonnet screw (3/8″ or 1/2″ NPT pipe size)	25	2,8
bonnet screw (3/4″ NPT pipe size)	40	4,5

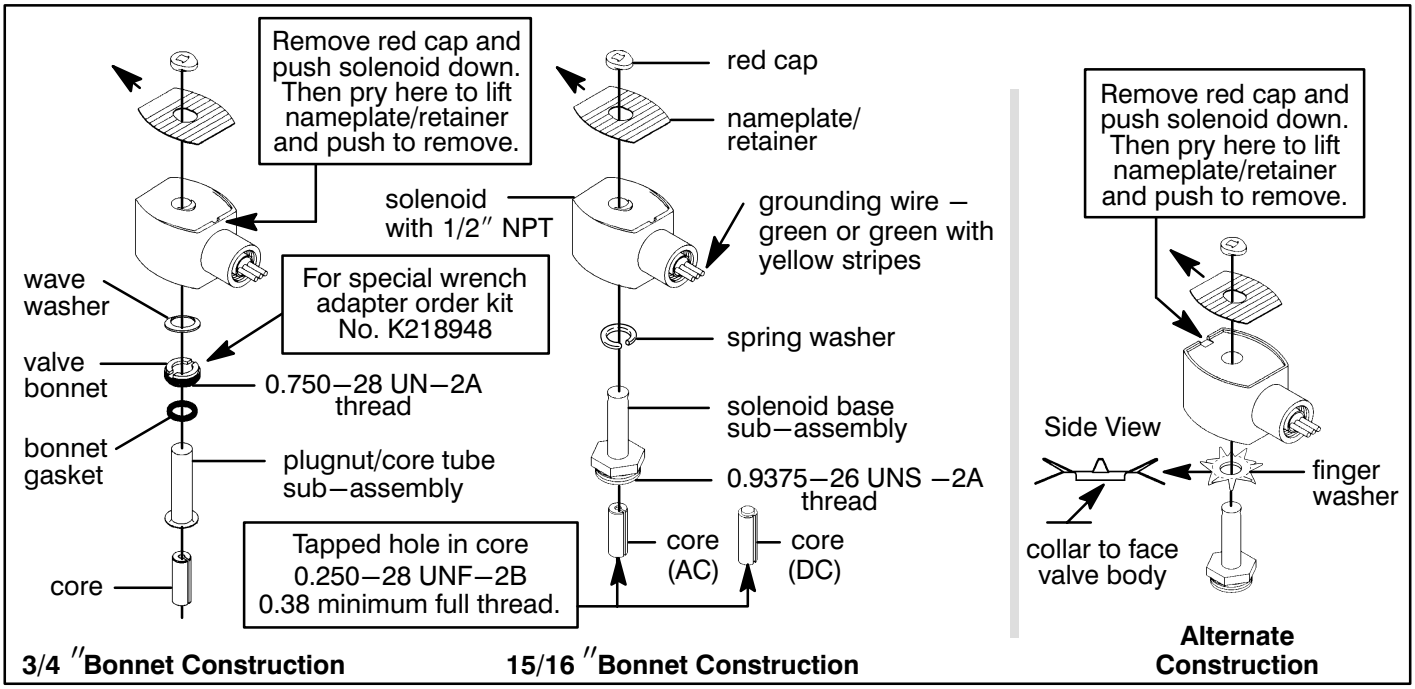
Remove red cap and push solenoid down. Then pry here to lift nameplate/retainer and push to remove.
red cap
nameplate/ retainer
solenoid with 1/2″ NPT
grounding wire — green or green with yellow stripes
wave washer
For special wrench adapter order kit No. K218948
valve bonnet
0.750—28 UN—2A thread
spring washer
solenoid base sub—assembly
bonnet gasket
plugnut/core tube sub—assembly
0.9375—26 UNS —2A thread
Tapped hole in core 0.250—28 UNF—2B 0.38 minimum full thread.
core
core (AC)
core (DC)
3/4 ″Bonnet Construction
15/16 ″Bonnet Construction
Remove red cap and push solenoid down. Then pry here to lift nameplate/retainer and push to remove.
Side View
finger washer
collar to face valve body
Alternate Construction

Figure 1. Series 8016G solenoids

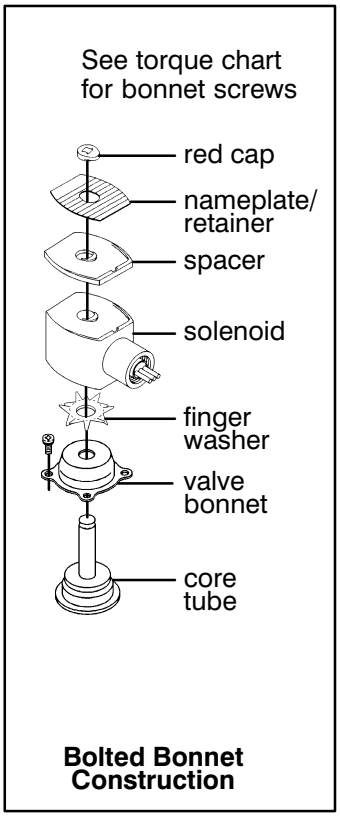

Figure 2. Series 8016G solenoid

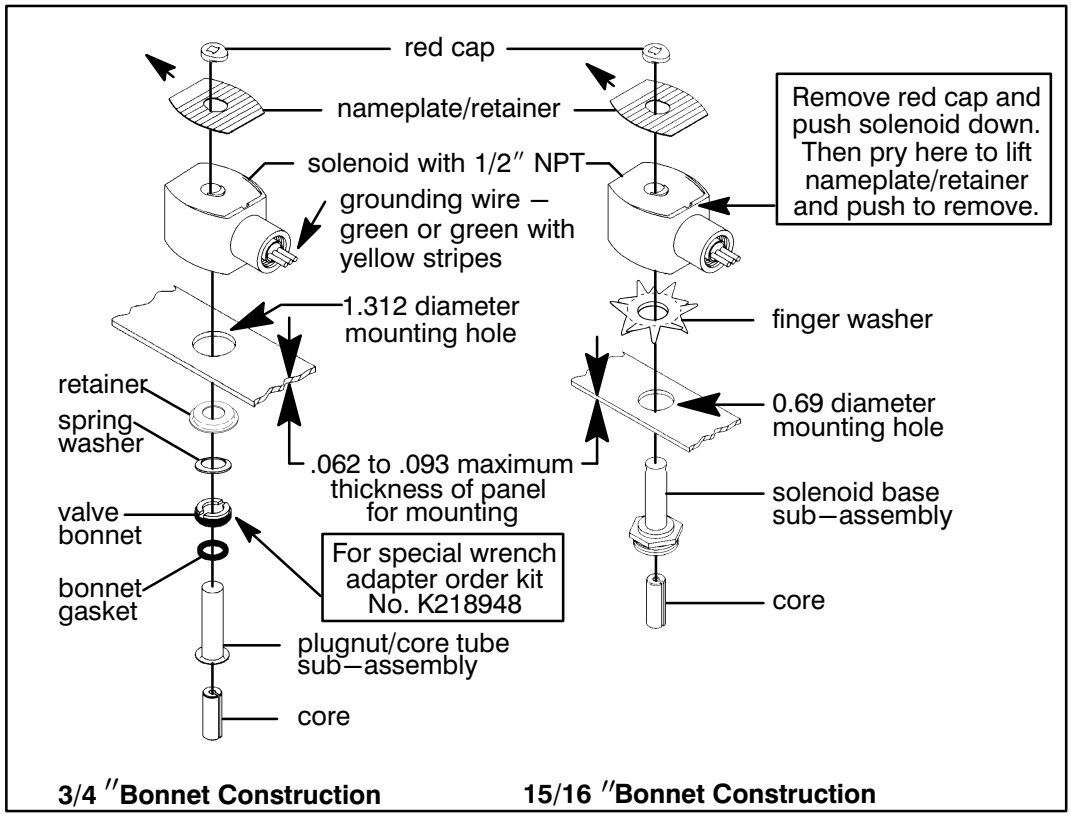
red cap
nameplate/retainer
solenoid with 1/2″ NPT
grounding wire — green or green with yellow stripes
1.312 diameter mounting hole
retainer
spring washer
.062 to .093 maximum thickness of panel for mounting
valve bonnet
For special wrench adapter order kit No. K218948
bonnet gasket
plugnut/core tube sub—assembly
core
3/4 ″Bonnet Construction
Remove red cap and push solenoid down. Then pry here to lift nameplate/retainer and push to remove.
finger washer
0.69 diameter mounting hole
solenoid base sub—assembly
core
15/16 ″Bonnet Construction

Figure 3. Series 8016G panel mounted solenoids

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Torque Chart

Part Name	Torque Value in Inch—Pounds	Torque Value in Newton—Meters
terminal block screws	10 ± 2	1,1 ± 0,2
socket head screw	15 — 20	1,7 — 2,3
center screw	5 ± 1	0,6 ± 0,1

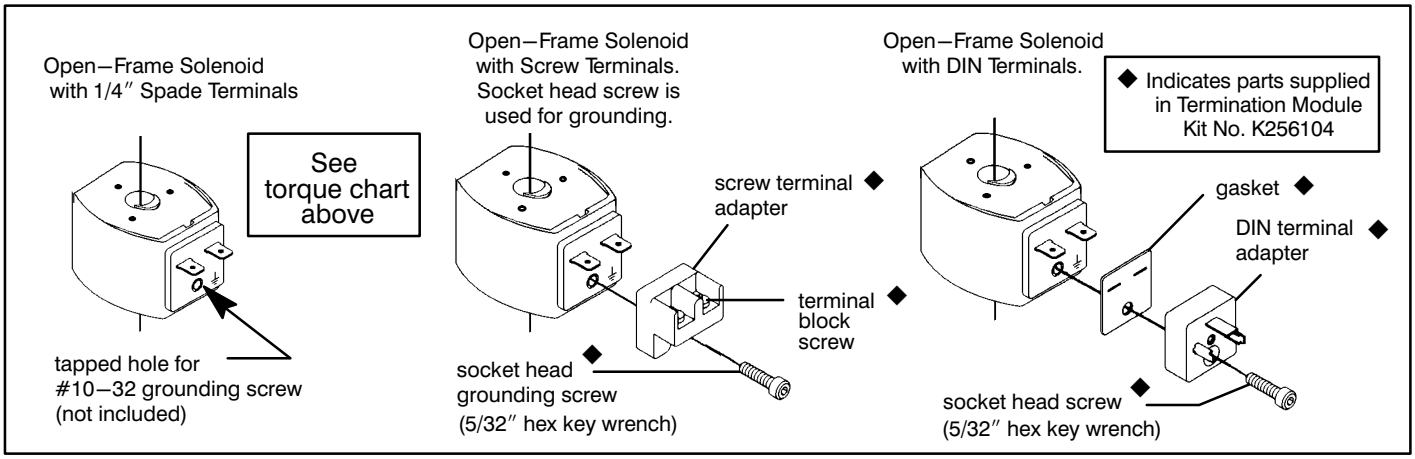
Open—Frame Solenoid with 1/4″ Spade Terminals
See torque chart above
tapped hole for #10—32 grounding screw (not included)
Open—Frame Solenoid with Screw Terminals. Socket head screw is used for grounding.
screw terminal adapter ◆
terminal block screw ◆
socket head grounding screw ◆ (5/32″ hex key wrench)
Open—Frame Solenoid with DIN Terminals.
◆ Indicates parts supplied in Termination Module Kit No. K256104
gasket ◆
DIN terminal adapter ◆
socket head screw ◆ (5/32″ hex key wrench)

Figure 4. Open—frame solenoids

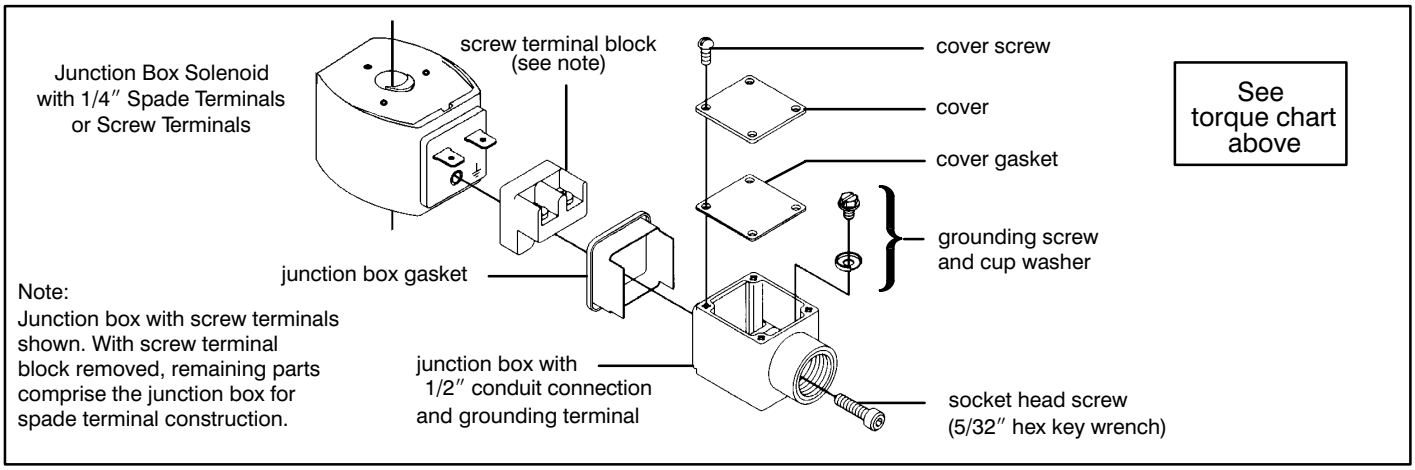
Junction Box Solenoid with 1/4″ Spade Terminals or Screw Terminals
screw terminal block (see note)
cover screw
cover
cover gasket
grounding screw and cup washer
junction box gasket
junction box with 1/2″ conduit connection and grounding terminal
socket head screw (5/32″ hex key wrench)
See torque chart above
Note:
Junction box with screw terminals shown. With screw terminal block removed, remaining parts comprise the junction box for spade terminal construction.

Figure 5. Junction box (optional feature)

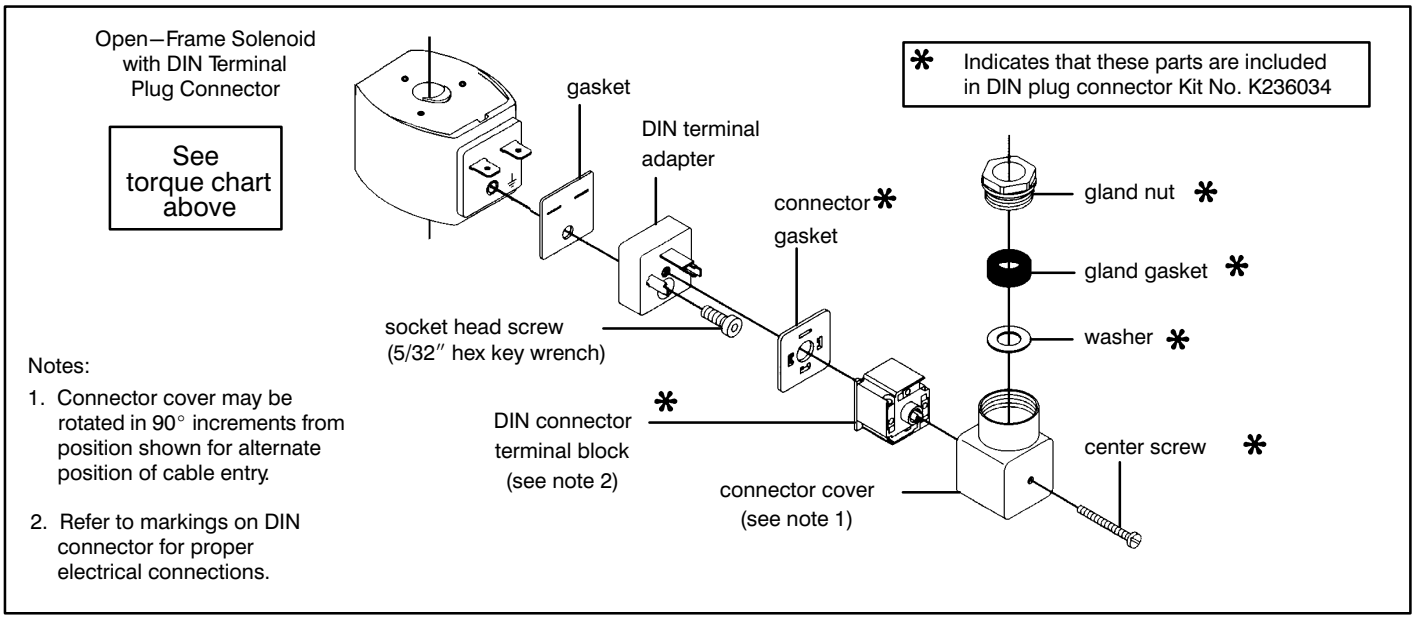
Open—Frame Solenoid with DIN Terminal Plug Connector
See torque chart above
* Indicates that these parts are included in DIN plug connector Kit No. K236034
gasket
DIN terminal adapter
connector gasket *
gland nut *
gland gasket *
washer *
socket head screw (5/32″ hex key wrench)
DIN connector terminal block (see note 2) *
center screw *
connector cover (see note 1)
Notes:
1. Connector cover may be rotated in 90° increments from position shown for alternate position of cable entry.
2. Refer to markings on DIN connector for proper electrical connections.

Figure 6. DIN plug connector kit No. K236034 (optional feature)

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Installation & Maintenance Instructions

2–WAY INTERNAL PILOT–OPERATED SOLENOID VALVES
NORMALLY CLOSED OPERATION — GENERAL SERVICE
1″, 1¼″ OR 1½″ NPT

SERIES
8210
8211

I&M No.V5436R7

NOTICE: See separate solenoid installation and maintenance instructions for information on: Wiring, Solenoid Temperature, Cause of Improper Operation, Coil or Solenoid Replacement.

DESCRIPTION

Series 8210 valves are 2–way normally closed internal pilot–operated solenoid valves designed for general service. Valves are made of rugged forged brass. Series 8210 valves are provided with a general purpose solenoid enclosure.
Series EF8210 and 8211 are the same as Series 8210 except they are provided with an explosionproof or explosionproof/watertight solenoid enclosure.

OPERATION

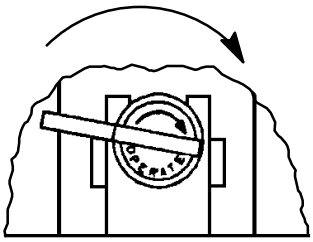
Normally Closed: Valve is closed when solenoid is de–energized; open when energized.

IMPORTANT: Minimum operating pressure differential is 5 psi.

Manual Operator (optional feature)

Manual operator allows manual operation when desired or during an electrical power outage. To engage manual operator (open the valve), turn lever clockwise until it hits a stop. Valve will now be in the same position as when the solenoid is energized. To disengage manual operator (close the valve), turn lever counterclockwise until it hits a stop.

To engage, turn lever clockwise until it hits a stop.



Partial view of Manual Operator

⚠ CAUTION: For valve to operate electrically, manual operator lever must be fully rotated counterclockwise.

INSTALLATION

Check nameplate for correct catalog number, pressure, voltage, frequency, and service. Never apply incompatible fluids or exceed pressure rating of the valve. Installation and valve maintenance to be performed by qualified personnel.

Future Service Considerations

Provision should be made for performing seat leakage, external leakage, and operational tests on the valve with a nonhazardous, noncombustible fluid after disassembly and reassembly.

Temperature Limitations

For maximum valve ambient and fluid temperatures, refer to chart below. Check catalog number prefix and watt rating on nameplate.

Watt Rating AC/DC	Catalog Number Prefix	Solenoid Class	Maximum Ambient Temp.	Maximum Fluid Temp.
6 AC	None or DF	F	122°F (50°C)	180°F (82°C)
	HT	H	140°F (60°C)	180°F (82°C)
6.1 AC	None, KF, SF or SC	F	125°F (54° C)	180°F (82°C)
	HT, KH, ST or SU	H	140°F (60°C)	180°F (82°C)
11.2 DC	None or HT	F or H	77°F (25°C)	150°F (65°C)
11.6 DC	None, HT, KF, KH, SC, SF or ST	F or H	104°F (40°C)	150°F (65°C)

Positioning

This valve is designed to perform properly when mounted in any position. However, for optimum life and performance, the solenoid should be mounted vertically and upright to reduce the possibility of foreign matter accumulating in the solenoid base sub–assembly area.

Piping

Connect piping to valve according to markings on valve body. Apply pipe compound sparingly to male pipe threads only. If applied to valve threads, the compound may enter the valve and cause operational difficulty. Avoid pipe strain by properly supporting and aligning piping. When tightening the pipe, do not use valve or solenoid as a lever. Locate wrenches applied to valve body or piping as close as possible to connection point.

⚠ CAUTION: To protect the solenoid valve, install a strainer or filter suitable for the service involved in the inlet side as close to the valve as possible. Clean periodically depending on service conditions. See ASCO Series 8600, 8601 and 8602 for strainers.

MAINTENANCE

⚠ WARNING: To prevent the possibility of death, serious injury or property damage, turn off electrical power, depressurize valve, and vent fluid to a safe area before servicing the valve.

NOTE: It is not necessary to remove the valve from the pipeline for repairs.

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Cleaning

All solenoid valves should be cleaned periodically. The time between cleanings will vary depending on the medium and service conditions. In general, if the voltage to the coil is correct, sluggish valve operation, excessive noise or leakage will indicate that cleaning is required. In the extreme case, faulty valve operation will occur and the valve may fail to open or close. Clean strainer or filter when cleaning the valve.

Preventive Maintenance

- Keep medium flowing through the valve as free from dirt and foreign material as possible.
- Periodic exercise of the valve should be considered if ambient or fluid conditions are such that corrosion, elastomer degradation, fluid contamination build up, or other conditions that could impede solenoid valve shifting are possible. The actual frequency of exercise necessary will depend on specific operating conditions. A successful operating history is the best indication of a proper interval between exercise cycles.
- Depending on the medium and service conditions, periodic inspection of internal valve parts for damage or excessive wear is recommended. Thoroughly clean all parts. If parts are worn or damaged, install a complete rebuild kit.

Causes of Improper Operation

- **Incorrect Pressure:** Check valve pressure. Pressure to valve must be within range specified on nameplate.
- **Excessive Leakage:** Disassemble valve and clean all parts. If parts are worn or damaged, install a complete ASCO Rebuild Kit.

Valve Disassembly

1. Disassemble valve in an orderly fashion using exploded views for identification and placement of parts. Refer to Figure 1 for AC construction; Figure 2 for DC construction. For 1″ or 1 ¼″ NPT valve construction, see Figure 1; for 1 ½″ NPT valve construction, see Figure 2.
2. Remove solenoid enclosure. See separate instructions.

- For valves supplied with optional manual operators, see section on ***Disassembly of Manual Operator***.

3. Unscrew solenoid base sub−assembly from valve body. Then remove core assembly with core spring and solenoid base gasket. For AC construction (Figure 1) core spring is a loose piece.
4. For normal maintenance (cleaning) it is not necessary to remove the valve seat. However, for valve seat removal use a 7/16″ thin wall socket wrench
5. Remove bonnet screws, valve bonnet, diaphragm spring, diaphragm assembly, body gasket, body passage eyelet (present on current valve constructions only) and body passage gasket.
6. All parts are now accessible for cleaning or replacement. If parts are worn or damaged, install a complete ASCO Rebuild Kit.

– Service Notice –

When installing a new ASCO Rebuild Kit, please be aware that the diaphragm assembly may not be identical to the diaphragm assembly in the valve. See Figure 1 for alternate diaphragm constructions. The two diaphragm constructions are interchangeable and will perform equally well.

⚠ CAUTION: To ensure proper valve operation, install all parts supplied in ASCO Rebuild Kit. Do not mix old and new parts.

Valve Reassembly

1. Lubricate body gasket, body passage gasket, bonnet gasket and solenoid base gasket with DOW CORNING® 200 Fluid lubricant or an equivalent high−grade silicone fluid.
2. Install body passage gasket, body passage eyelet, diaphragm assembly, diaphragm spring, valve bonnet and bonnet screws. Hand thread screws as far as possible. Then torque bonnet screws in a crisscross manner to 144 ± 15 in−lbs [16,3 ± 1,7 Nm].
3. If removed, install valve seat in valve body. Apply a small amount of thread compound compatible with valve media to valve seat threads. Torque valve seat to 75 ± 10 in−lbs [8,5 ± 1,1 Nm].

- For valves supplied with optional manual operator, see section on ***Reassembly of Manual Operator***.

4. For AC construction (Figure 1), install core spring in core assembly. Wide end of core spring in core first, closed end protrudes from top of core.
5. Install solenoid base gasket, core assembly with core spring and solenoid base sub−assembly in valve body. Torque solenoid base sub−assembly to 175 ± 25 in−lbs [19,8 ± 2,8 Nm].
6. Install solenoid. See separate instructions.

⚠ WARNING: To prevent the possibility of death, serious injury or property damage, check valve for proper operation before returning to service. Also perform internal seat and external leakage tests with a nonhazardous, noncombustible fluid.

7. Restore line pressure and electrical power supply to valve.
8. After maintenance is completed, operate the valve a few times to be sure of proper operation. A metallic *click* indicates the solenoid is operating.

Disassembly of Manual Operator

1. Unscrew solenoid base sub−assembly from manual operator body.
2. Unscrew manual operator body from valve body. Then remove stem retainer from base of manual operator body and stem/spacer sub−assembly.
3. Pull stem/spacer sub−assembly with stem gasket from side of manual operator body. Then remove core assembly with core spring, solenoid base gasket and manual operator bonnet gasket.
4. For further disassembly refer to section on ***Valve Disassembly*** step 4.

Reassembly of Manual Operator

1. Lubricate stem gasket with DOW CORNING® 111 Compound lubricant or an equivalent high−grade silicone grease.
2. For AC construction (Figure 1), install core spring in core assembly. Wide end of core spring in core first, closed end protrudes from top of core.
3. Holding the manual operator body in a horizontal position, install core assembly with core spring from the bottom end.
4. Insert the stem/spacer sub−assembly with the stem gasket into the side hole of the manual operator body. Rotate the lever of the stem/spacer sub−assembly to the 12 o'clock position.
5. Install stem retainer on base of manual operator body and simultaneously engage it into the slot provided on the stem/spacer sub−assembly.

IMPORTANT: The spacer on the stem/spacer sub−assembly *must be inside* of the stem retainer for AC construction (Figure 1) and *outside* of the stem retainer for DC construction (Figure 2).

6. Install manual operator bonnet gasket and body with preassembled parts into valve body. Torque manual operator body to 175 ± 25 in−lbs [19,8 ± 2,8 Nm].
7. Replace solenoid base gasket and solenoid base sub−assembly. Torque solenoid base sub−assembly to 175 ± 25 in−lbs [19,8 ± 2,8 Nm].
8. For further reassembly, refer to ***Valve Reassembly*** step 6.

Torque Chart

Part Name	Torque Value Inch–Pounds	Torque Value Newton–Meters
Solenoid base sub–assembly	175 ± 25	19,8 ± 2,8
Manual operator body		
Bonnet screw	144 ± 15	16,3 ± 1,7
Valve seat	75 ± 10	8,5 ± 1,1

ORDERING INFORMATION FOR ASCO REBUILD KITS

Parts marked with an asterisk (*) in the exploded view are supplied in Rebuild Kits. When Ordering Rebuild Kits for ASCO valves, order the Rebuild Kit number stamped on the valve nameplate. If the number of the kit is not visible, order by indicating the number of kits required, and the Catalog Number and Serial Number of the valve(s) for which they are intended.

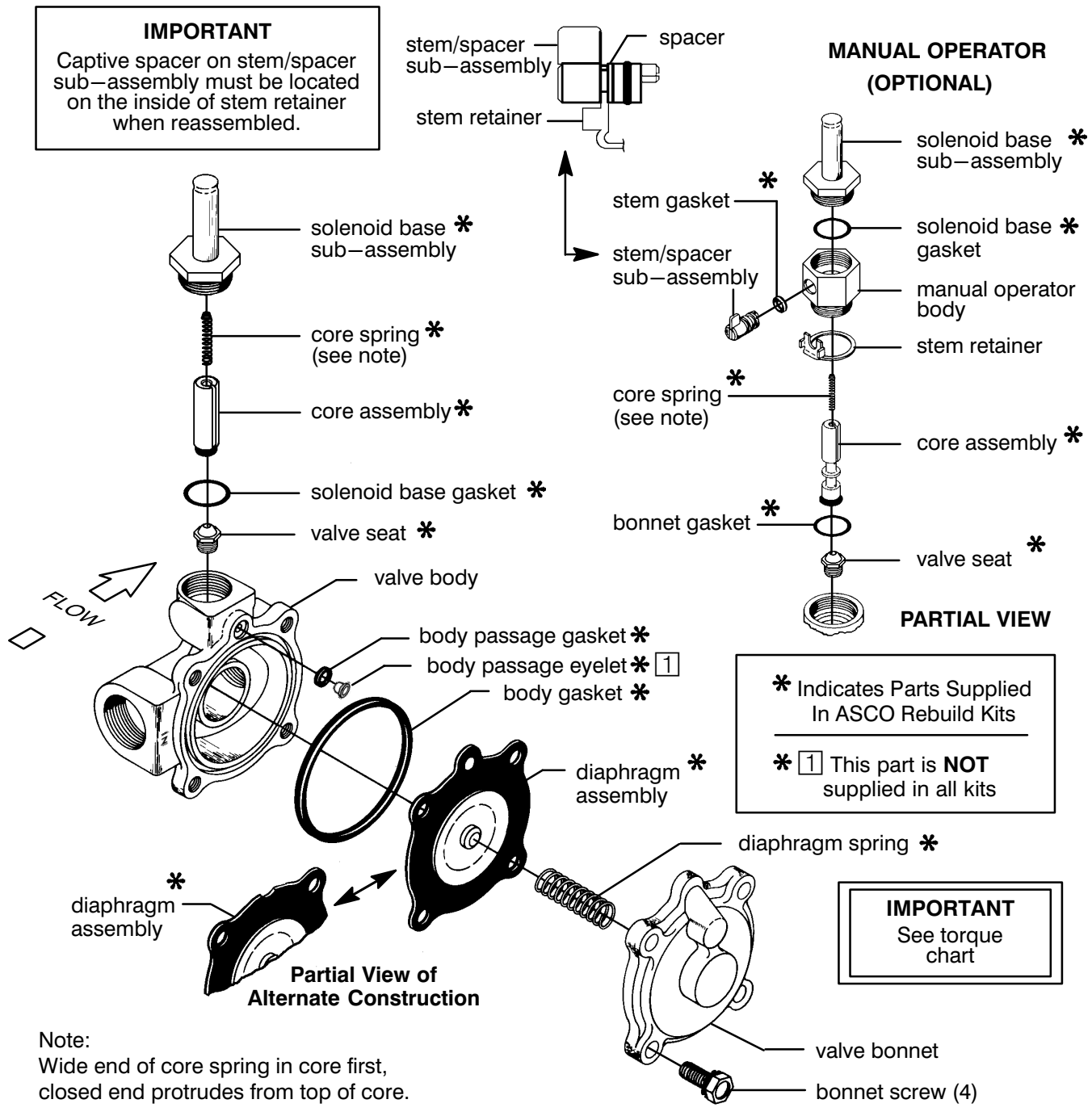

Figure 1. Series 8210 valve without solenoid, AC construction with 1″ or 1 ¼″ NPT valve body shown.

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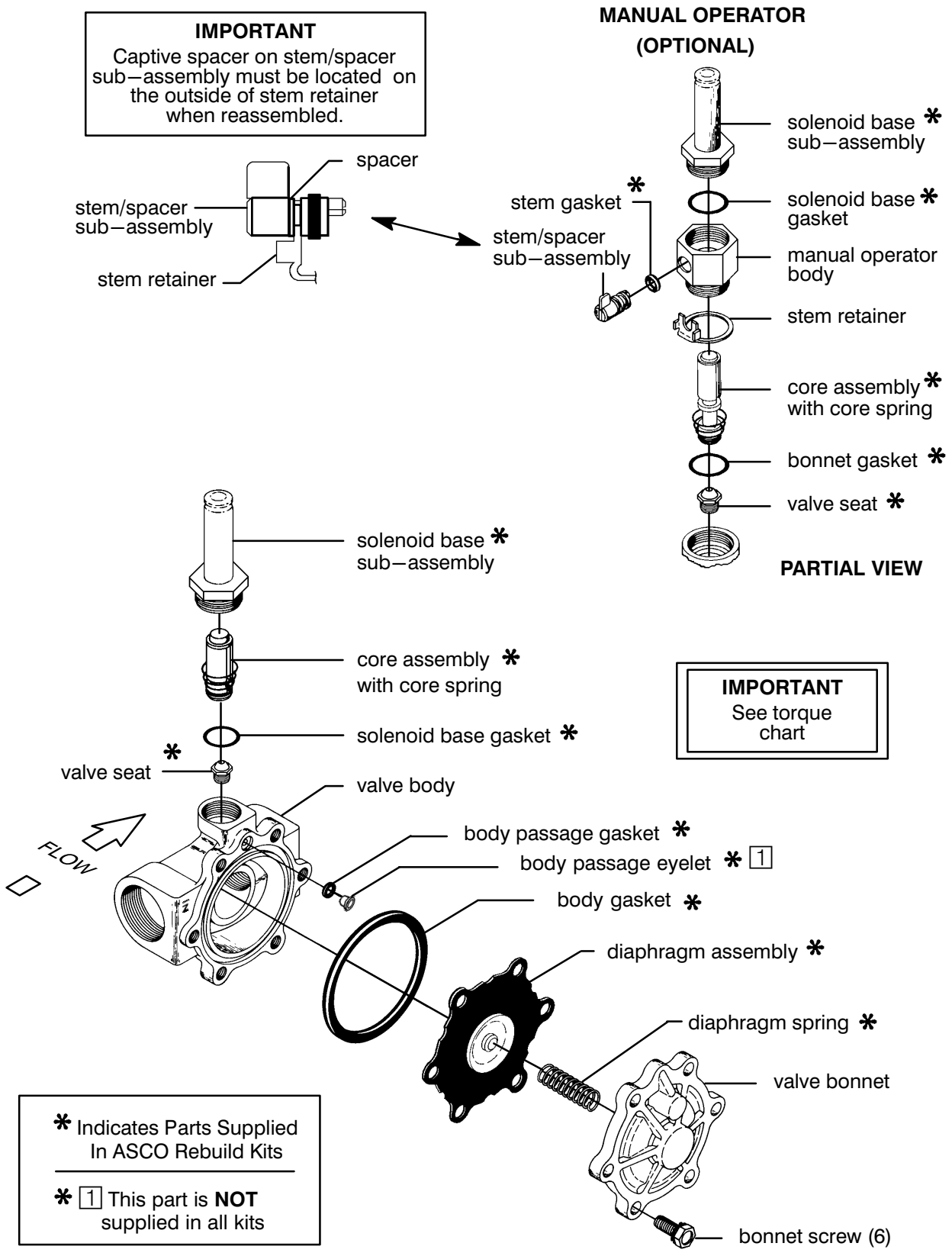

Figure 2. Series 8210 valve without solenoid, DC construction with 1 ½″ NPT valve body shown.

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Installation & Maintenance Instructions

2–WAY INTERNAL PILOT–OPERATED SOLENOID VALVES
NORMALLY CLOSED OPERATION
2″ OR 2½″ NPT

SERIES
8210
8211
I&M No.V6296R2

IMPORTANT: See separate solenoid installation and maintenance instructions for information on: Wiring, Solenoid Temperature, Cause of Improper Operation, Coil or Solenoid Replacement.

DESCRIPTION

Series 8210 valves are 2–way normally closed, internal pilot operated solenoid valves designed for general service. These valves are made of rugged forged brass and have an integral adjustable bleed device for controlling the opening and closing speed of the piston. Series 8210 valves are supplied with general purpose, or explosionproof/watertight solenoids.

Series 8211 valves are the same as Series 8210 except they are provided with a metal explosionproof/watertight solenoid enclosure.

OPERATION

Normally Closed: Valve is closed when solenoid is de–energized; open when energized.

IMPORTANT: Minimum operating pressure differential required is 5 psi.

Adjustable Bleed Device

Series 8210 valves have an integral adjustable bleed device for controlling the opening and closing speed of the piston. When valve leaves the factory, the bleed adjusting screw (metering pin) has been preset to provide quick shockless closing for most applications. If faster or slower closing is required, adjust the screw (metering Pin) as follows:

1. Turn metering pin in (clockwise) as far as possible without over tightening. Back out tightening. Back out metering pin (counterclockwise) two complete turns. From this point, adjustments may be made to suit system.
2. Turn metering pin clockwise for slower closing.
3. Turn metering pin counterclockwise for faster closing.

Manual Operation (Optional Feature)

Valves with suffix ***MO*** in the catalog number are provided with a manual operator which allows manual operation when desired or during an electrical power outage.

To engage manual operator, rotate stem fully clockwise (approximately 180°). Valve will now be in the same position as when the solenoid is energized.

To disengage manual operator, rotate stem fully counterclockwise (approximately 180°) before operating electrically.

⚠ **CAUTION:** Manual operator stem must be fully rotated counterclockwise before electrical operation.

INSTALLATION

Check nameplate for correct catalog number, pressure, voltage, frequency, and service. Never apply incompatible fluids or exceed pressure rating of the valve. Installation and valve maintenance to be performed by qualified personnel.

Future Service Considerations

Provision should be made for performing seat leakage, external leakage, and operational tests on the valve with a nonhazardous, noncombustible fluid after disassembly and reassembly.

Temperature Limitations

For maximum valve ambient and fluid temperatures, refer to chart below. Check catalog number prefix on nameplate to determine the maximum temperatures.

Construction	Catalog Number Prefix	Coil Class	Maximum Ambient Temp.°F	Maximum Fluid Temp.°F
AC	None or FT	F	122	180
	HT	H	140	180
DC	None,FT or HT	F or H	77	150

Positioning

This valve is designed to perform properly when mounted in any position. However, for optimum life and performance, the solenoid should be mounted vertically and upright to reduce the possibility of foreign matter accumulating in the solenoid base sub–assembly area.

Piping

Connect piping or tubing to valve according to markings on valve body. Apply pipe compound sparingly to male pipe threads only. If applied to valve threads, the compound may enter the valve and cause operational difficulty. Avoid pipe strain by properly supporting and aligning piping. When tightening the pipe, do not use valve or solenoid as a lever. Locate wrenches applied to valve body or piping as close as possible to connection point.

IMPORTANT: To protect the solenoid valve, install a strainer or filter, suitable for the service involved, in the inlet side as close to the valve as possible. Clean periodically depending on service conditions. See ASCO Series 8600, 8601 and 8602 for strainers.

MAINTENANCE

⚠ **WARNING: To prevent the possibility of death, personal injury or property damage, turn off electrical power, depressurize valve, and vent fluid to a safe area before servicing the valve.**

Note: It is not necessary to remove the valve from the pipeline for repairs.

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Cleaning

All solenoid valves should be cleaned periodically. The time between cleanings will vary depending on the medium and service conditions. In general, if the voltage to the coil is correct, sluggish valve operation, excessive noise or leakage will indicate that cleaning is required. In the extreme case, faulty valve operation will occur and the valve may fail to open or close. Clean valve strainer or filter when cleaning the valve.

Preventive Maintenance

- Keep medium flowing through the valve as free from dirt and foreign material as possible.
- Periodic exercise of the valve should be considered if ambient or fluid conditions are such that corrosion, elastomer degradation, fluid contamination build up, or other conditions that could impede solenoid valve shifting are possible. The actual frequency of exercise necessary will depend on specific operating conditions. A successful operating history is the best indication of a proper interval between exercise cycles.
- Depending on the medium and service conditions, periodic inspection of internal valve parts for damage or excessive wear is recommended. Thoroughly clean all parts. If parts are worn or damaged, install a complete rebuild kit.

Causes of Improper Operation

- **Incorrect Pressure:** Check valve pressure. Pressure to valve must be within range specified on nameplate.
- **Excessive Leakage:** Disassemble valve and clean all parts. If parts are worn or damaged, install a complete ASCO Rebuild Kit.

Valve Disassembly (Refer to Figure 3 on page 4)

1. Disassemble valve in an orderly fashion. Use exploded views for identification and placement of parts.
2. Remove solenoid, see separate instructions.
3. If the valve being serviced has a manual operator, ***suffix MO*** in the catalog number, refer to section on ***Manual Operator Disassembly***.
4. Unscrew solenoid base sub−assembly and remove solenoid base gasket, core assembly with core spring.
5. For normal maintenance, it is not necessary to remove the valve seat. However, if valve seat removal is required, use a 7/16″ socket wrench.
6. Dislodge retainer from metering pin passageway and remove metering pin with gasket. Then remove metering pin gasket from metering pin.
7. Remove bonnet screws, valve bonnet, piston spring, piston assembly, support, lip seal, body gasket, and body passage gasket.
8. Remove aspirator tube and disc with disc gasket from piston.
9. All parts are now accessible to clean or replace. If parts are worn or damaged, install a complete ASCO Rebuild kit.

Valve Reassembly

1. Reassemble valve using exploded views for identification and placement of parts.
2. Lubricate the solenoid base gasket, body gasket, body passage gasket, metering pin gasket, and the surface of the piston which contacts the lip seal with DOW CORNING® 200 Fluid lubricant.
3. Lubricate disc and disc gasket with DOW CORNING® 111 Compound lubricant or an equivalent high−grade silicone grease.
4. Position body gasket, body passage gasket, and support in valve body.
5. Install aspirator tube and disc with disc gasket in piston.
6. Position lip seal, flanged end out, onto piston assembly. Install piston assembly with lip seal into support in valve body cavity.
7. Replace piston spring, valve bonnet, and bonnet screws. Torque bonnet screws in a crisscross manner to 144± 15 in−lbs [16,3 ± 1,7 Nm].
8. Replace valve seat with a small amount of thread compound on the seat threads. Torque valve seat to 65 ± 15 in−lbs [7,3 ± 1,7 Nm].
9. Install metering pin with metering pin gasket into valve body. Replace retainer and refer to ***Adjustable Bleed Device*** section for metering pin adjustment.
10. If the valve being serviced has a manual operator, refer to ***Manual Operator Reassembly*** section.
11. Replace solenoid base gasket, core assembly, core spring, and solenoid base sub−assembly. Torque solenoid base sub−assembly to 175 ± 25 in−lbs [19,8 ± 2,8].
12. Install solenoid, see separate instructions and make electrical hookup.

⚠ WARNING: To prevent the possibility of death, personal injury or property damage, check valve for proper operation before returning to service. Also perform internal seat and external leakage tests with a nonhazardous, noncombustible fluid.

13. Restore line pressure and electrical power supply to valve.
14. After maintenance is completed, operate the valve a few times to be sure of proper operation. A metallic *click* signifies the solenoid is operating.

Manual Operator Disassembly

1. Refer to ***Valve Disassembly*** section and follow step 1 and 2.
2. For AC construction refer to Figure 1 on page 3; DC construction Figure 2 on page 3.
3. Unscrew solenoid base sub−assembly from manual operator body.
4. Unscrew manual operator body and remove this assembly intact. Remove body gasket from main valve body.
5. Before removing the stem retainer from the manual operator body, note the location of captive spacing washer on the stem/lever sub−assembly. The captive spacing washer will be on the ***inside*** of the fork on the stem retainer for AC construction and on the ***outside*** for DC construction. Location of this captive spacing washer is important for reassembly.
6. Remove stem/lever sub−assembly with stem gasket from manual operator body. Remove solenoid base gasket, core assembly with core spring.

7. Refer to ***Valve Disassembly*** sections, step 5 for further disassembly

Manual Operator Reassembly

Refer to steps 1 through 9 of ***Valve Reassembly*** then proceed as follows:

1. Position stem gasket on stem/lever sub−assembly.
2. Preassemble manual operator parts as follows: Position core assembly with core spring into manual operator body from the bottom. Install stem/lever sub−assembly into manual operator body. Install stem retainer and be sure the captive spacing washer on the stem/lever sub−assembly is located on the ***inside*** of the fork on the stem retainer for AC construction and on the ***outside*** of the fork on the stem retainer for DC construction.
3. Replace body gasket in valve body.
4. Screw manual operator body intact into valve body. Torque manual operator body to 175± 25 in−lbs [19,8± 2,8 Nm].

ORDERING INFORMATION FOR ASCO REBUILD KITS

Parts marked with an asterisk (*) in the exploded view are supplied in Rebuild Kits.

•When Ordering Rebuild Kits for ASCO valves, order the Rebuild Kit number stamped on the valve nameplate.+

+If the number of the kit is not visible, order by indicating the number of kits required, and the Catalog Number and Serial Number of the valve(s) for which they are intended.

Torque Chart

Part Name	Torque Value in Inch−Pounds	Torque Value in Newton−Meters
Solenoid Base Sub−Assembly / Manual Operator Body	175 ± 25	19,8 ± 2,8
Valve Seat	65 ± 15	7,3 ± 1,7

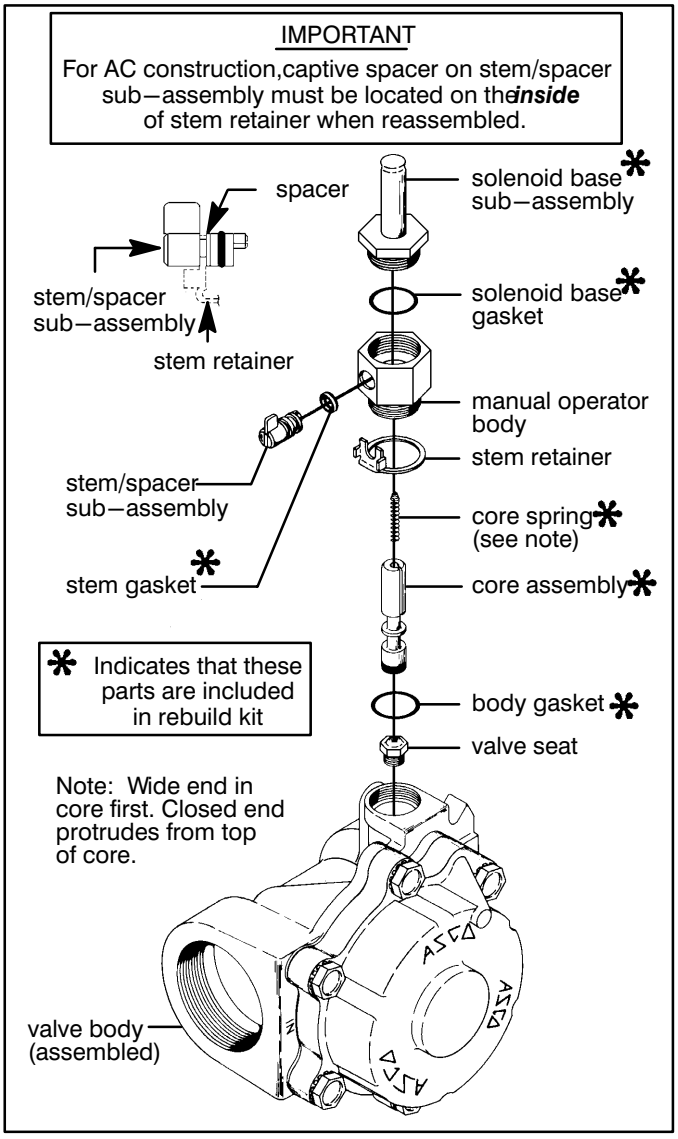
IMPORTANT
For AC construction,captive spacer on stem/spacer sub−assembly must be located on the inside of stem retainer when reassembled.
spacer
stem/spacer sub−assembly
stem retainer
stem/spacer sub−assembly
stem gasket *
solenoid base sub−assembly *
solenoid base gasket *
manual operator body
stem retainer
core spring * (see note)
core assembly *
body gasket *
valve seat
* Indicates that these parts are included in rebuild kit
Note: Wide end in core first. Closed end protrudes from top of core.
valve body (assembled)

Figure 1. Manual Operator Assembly, AC Construction.

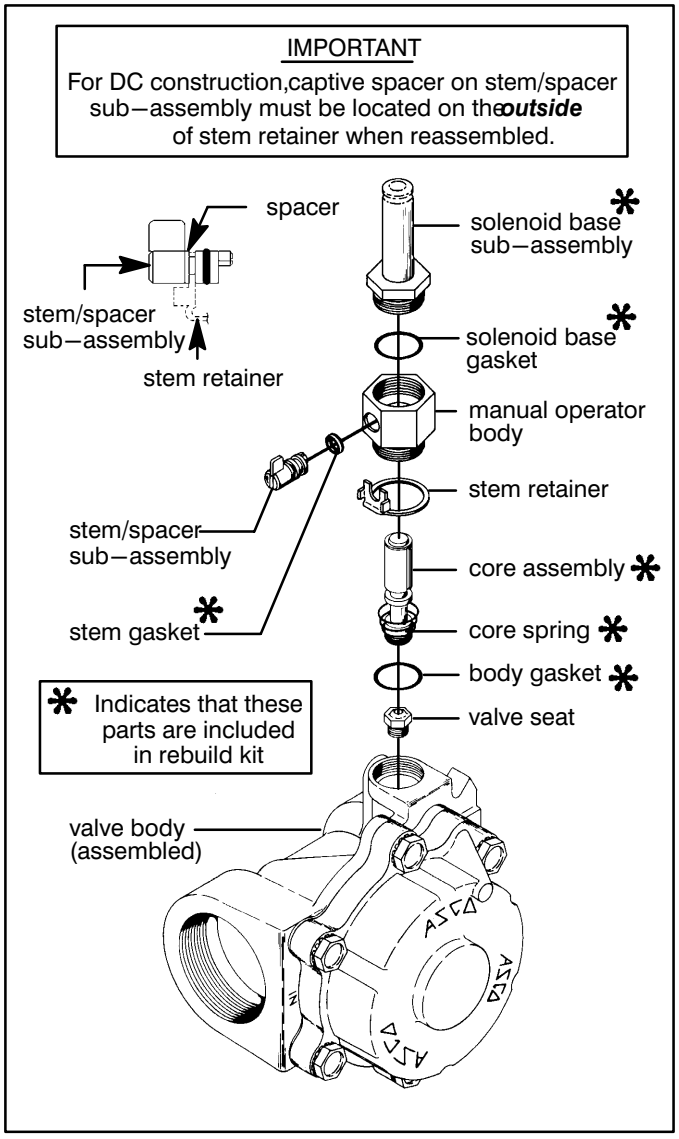

Figure 2. Manual Operator Assembly, DC construction.

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Torque Chart

Part Name	Torque Value in Inch−Pounds	Torque Value in Newton−Meters
Solenoid Base Sub−Assembly	175 ± 25	19,8 ± 2,8
Bonnet Screws	144 ± 15	16,3 ± 1,7
Valve Seat	65 ± 125	7,3 ± 1,7

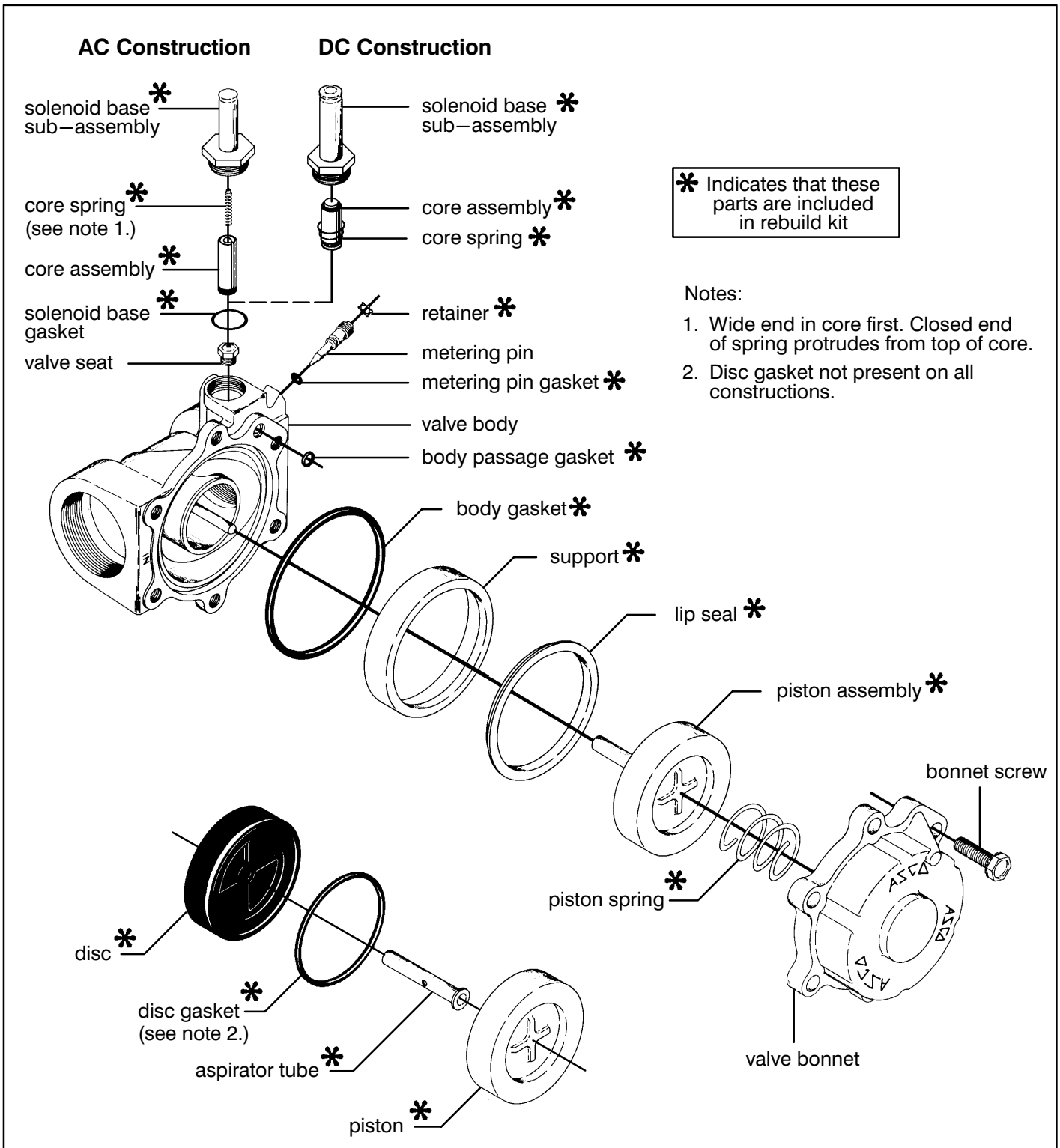

Figure 3. Series 8210 valve without solenoid.

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Installation & Parts Manual

Pulse Output Device (POD)

LIQUID CONTROLS
A Unit of IDEX Corporation

IDEX CORPORATION

Installation

www.lcmeter.com

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General Information

The Liquid Controls Pulse Output Device (POD) converts the rotary motion of the Liquid Controls Positive Displacement Flowmeter into electronic pulses. This allows the meter to interface with a wide variety of electronic monitoring devices and control equipment.

The POD mounts directly to the front cover of any Liquid Controls meter in place of the packing gland. The motion of the meter's blocking rotor is magnetically coupled through a stainless steel wall to the electronics compartment of the POD. This eliminates the dynamic seal of the packing gland and isolates the electronics from the process fluid in the meter.

Inside the electronics compartment, an optical shaft encoder converts the rotary motion into a high resolution, two-channel, quadrature square wave. Both outputs are driven by field effect transistors (FETs) and switch from zero volts in the "ON" state to the user's power supply voltage in the "OFF" state. As supplied from the factory, there is a 1.0 KΩ pull-up resistor on each output which can be removed from the circuit in the field to produce a true "Open Drain" (Open Collector) output. As Open Drain devices, the outputs can sink up to 100 mA in the "ON" state and sustain up to +30 VDC in the "OFF" state.

The electronics compartment also serves as a conduit junction box. The POD has an O-Ring sealed, threaded cover. The standard wire entrance is a ½-14 NPT female hub which accepts threaded conduit or a cable gland. A screw-type, removable, terminal block on the circuit board facilitates wiring of the unit. With the wiring entrance sealed and the cover in place, the housing has a weatherproof rating of NEMA 4X. In addition, the housing is UL and Canadian-UL explosion-proof rated (when installed with approved conduit) and ATEX rated flameproof (pending).

POD Models

There are five **POD** models available:

POD1: Fork Drive with Buna-N O-Ring,
100 PPR Quad Pulser, +8 to +24 VDC

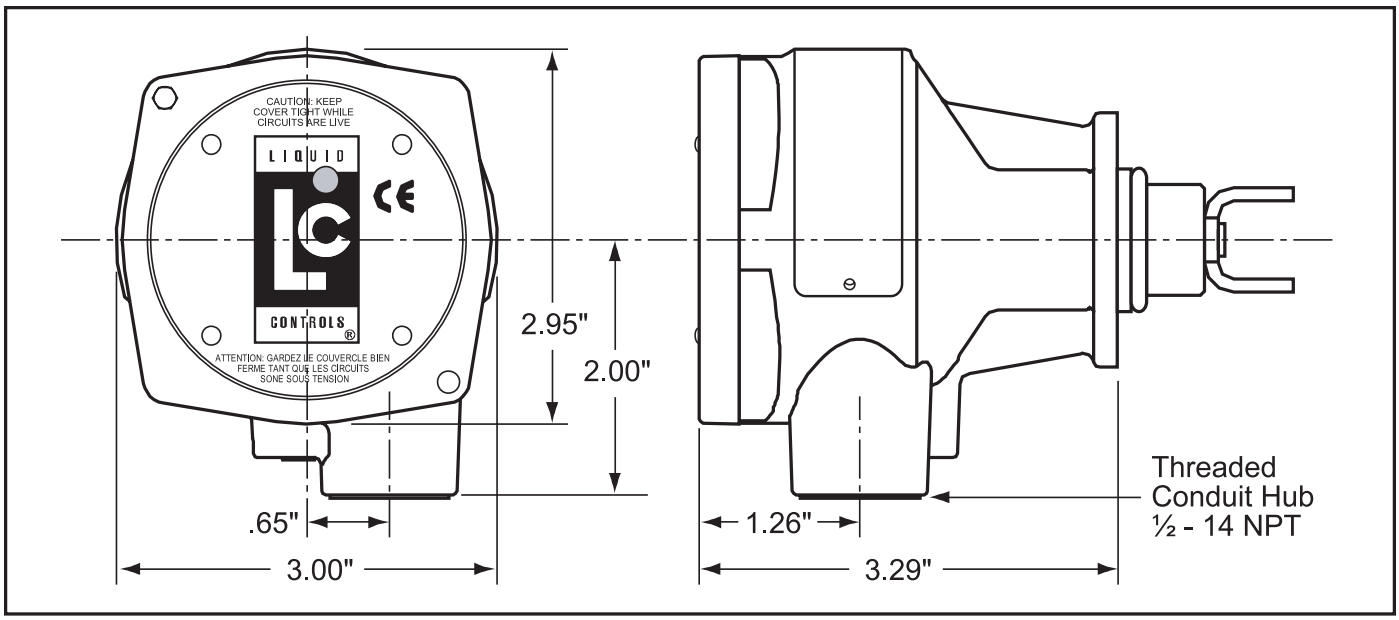
POD2: Fork Drive with Teflon O-Ring,
100 PPR Quad Pulser, +8 to +24 VDC

POD3: Blade Drive with Buna-N O-Ring,
100 PPR Quad Pulser, +8 to +24 VDC

POD4: Blade Drive with Teflon O-Ring,
100 PPR Quad Pulser, +8 to +24 VDC

POD5: Fork Drive with Buna-N O-Ring,
100 PPR Quad Pulser, +5 VDC

Dimensions



NOTE: Dimensions shown are not for construction use. Consult factory when certified Engineering Drawings are required.

- Voltage: (V+): +8 to +24 VDC (POD5 is +5 VDC) ±5%.
- Current supply: 26 mA typical.
- Output Signal Resolution: 100 pulses per encoder revolution, unscaled. For actual meter resolution, see table below.
- Square Wave: Single or dual quadrature channel output.
- Pulse Timing: Nominal 50% on and 50% off.
- Rise/Fall Time of Pulse: <5 µs.
- Operating Temperature Range: -40ºF to +185ºF (-40ºC to +85ºC).
- Output: Current sinking 100 mA maximum in "ON" state; V+ supply @ 1.0 KΩ in "OFF" state. Optional Open Drain FET (Field Effect Transistor). FET rating (drain to source voltage) +30 VDC maximum.
- Humidity Range: 0-100 %, non-condensing.
- Shock: 50 G's for 10 ms.
- Vibration: 1 G at 10-150 Hz.
- Electromagnetic Compatibility (EMI, RFI, etc.): to IEC 801 Standard.
- Pulse Transmission Distance: Up to 5,000 feet (1,524 meters).
- Operates in bidirectional flow applications.

Output Signal Resolution

M & MA Series Meters	Pulses/ Gallon/ Channel	Pulses/ Litre/ Channel	Max Output - kHz
MA-4	407.9	107.8	0.27
M-5, MA-5 (3:1)	407.9	107.8	0.41
M-5, MA-5 (1:1)	1,223.7	323.4	1.22
M-7, MA-7	555.5	146.8	0.93
M-10	555.5	146.8	1.48
M-15, MA-15	205.8	54.4	0.69
M-25	205.8	54.4	0.86
M-30, M-40	74.2	19.6	0.43
M-340	74.2	19.6	0.53
M-60 (new style)	39.8	10.5	0.40
M-60 (old style)	25.5	6.7	0.26
M-80	39.8	10.5	0.53

MS Series Meters	Pulses/ Gallon/ Channel	Pulses/ Litre/ Channel	Max Output - kHz
MS-7	555.5	146.8	0.93
MS-15	205.8	54.4	0.69
MS-25	205.8	54.4	0.86
MS-30	74.2	19.6	0.43
MS-40	74.2	19.6	0.53
MS-75	25.5	6.7	0.30
MS-120	15.8	4.2	0.26

Installation

New Installations

When ordered with the flowmeter, the POD comes factory installed on the meter and ready for wiring. Refer to the detailed wiring information which begins on Page 7.

POD Installed on meter.

⚠ WARNING

Relieve Internal Pressure

All internal pressure must be relieved to zero before disassembly or inspection of the meter or any of the meter accessories.

Serious injury or death from fire or explosion could result from servicing an improperly depressurized and evacuated system.

Retrofit Installations

Removing Existing Hardware

1. **Relieve the pressure** from the process piping to the meter.

2. **Drain** the meter by opening the meter's drain plugs.

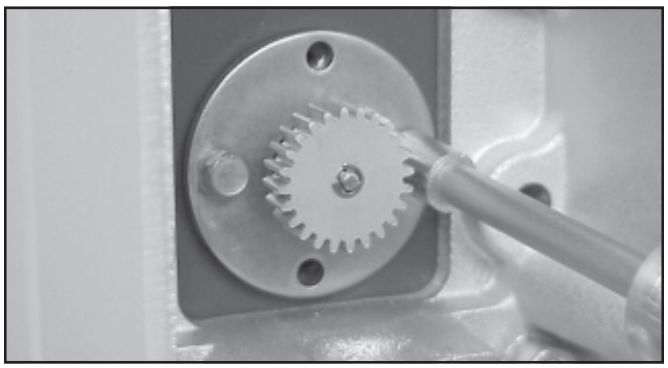
3. Remove the mechanical counter, adjuster, and adjuster drive shaft from the front of the meter.

4. Some meters have a counter adapter bracket which is bolted on. If this is the case, remove the counter bracket by removing the bolts that hold it in place. If the counter adapter bracket is integral to the meter, it cannot be removed. In this case, one of four POD Pulser Extensions will be required.

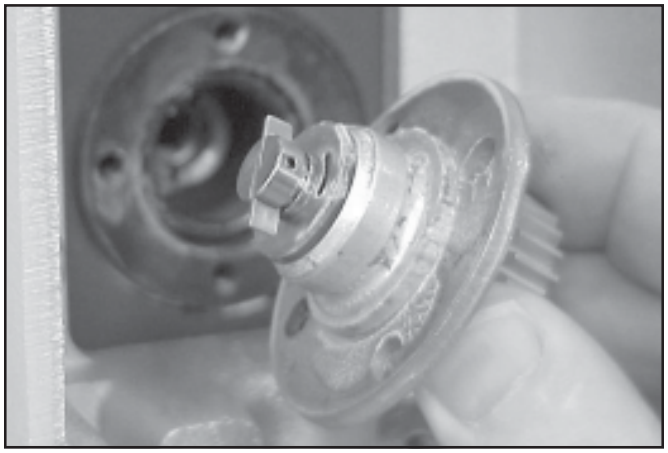
NOTE: Ensure there is no pressure inside the flowmeter before attempting to remove the packing gland. LINE PRESSURE MUST BE 0.0 PSI.

5. Remove the packing gland mounting screws. Pull the packing gland out of the meter. If the O-Ring does not come out with the packing gland, be sure to remove it from the packing gland well before installing the POD.

   When this is complete, the POD can be installed.



Remove Packing Gland Mounting Screws



Packing Gland Removed

Installing the POD

1. Verify that the proper POD Model was obtained by comparing the driver tang on the POD to the driver tang on the packing gland that was removed in Step 5 of **Removing Existing Hardware** on Page 4. There are two types of packing gland/POD driver tangs: **blade** type and **fork** type. Blade type packing glands must be replaced with blade type PODs. Fork type packing glands must be replaced with fork type PODs.

2. Determine the desired orientation of the conduit hub. The hub can be positioned in one of eight possible orientations as shown in the figure to the right.

NOTE: Meters with only two packing gland mounting screws are limited to four orientations.

NOTE: When using a cable gland to seal the wire entrance, any of the eight orientations can be used. However, when using conduit, the hub should face down so moisture that may accumulate in the conduit will drain away from the POD electronics.

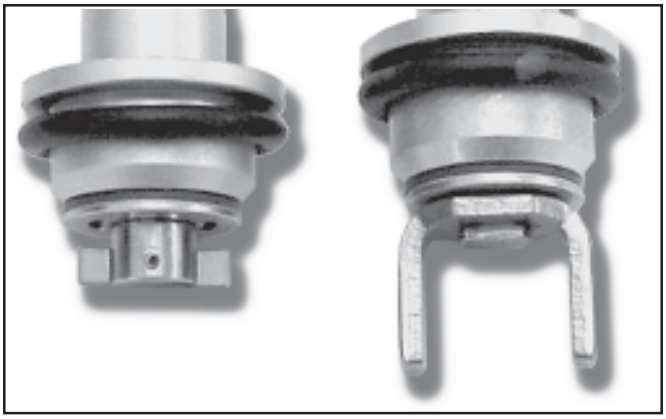
3. Position the O-Ring over the bottom of the POD as shown to the right.

4. Align the fork style or blade style driver with the drive mechanism in the meter and guide the POD into the opening in the meter cover. When properly aligned, the POD will go in until its mounting flange abuts the meter cover.

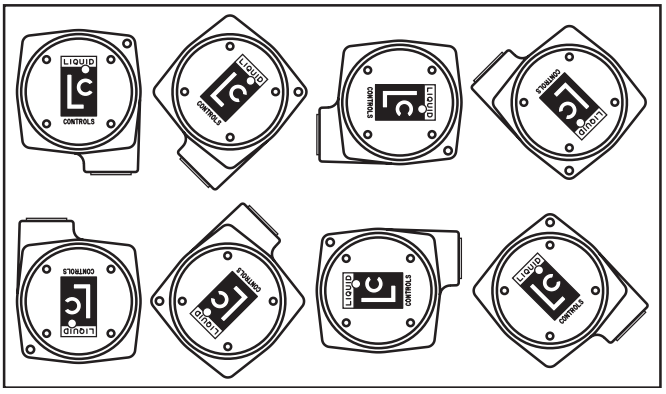
5. Rotate the POD to the desired orientation and thread in the mounting screws until they are snug. Using a 7/32" box end wrench, tighten the screws and torque them to 21-25 inch-pounds.

6. Proceed to Page 7 for wiring instructions.

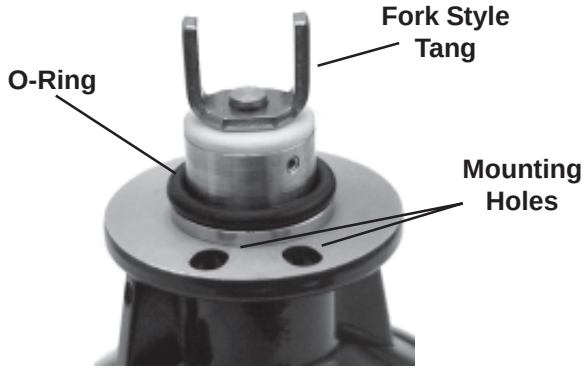
NOTE: If a POD Extension Kit is required, it must be installed prior to installation of the POD. This is addressed on Page 6.



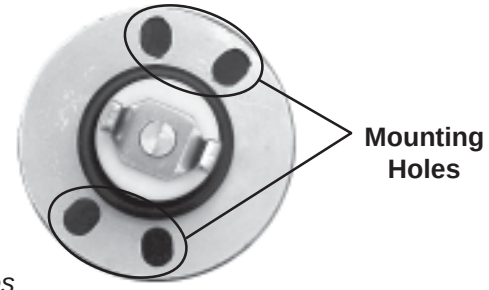
Blade Style Tang (Left) and Fork Style Tang (Right)



POD Conduit Hub Orientations



O-Ring Position & Mounting Holes



Mounting Holes

Installation

Installing the POD Extension

The POD Extension is used when the meter has an integral counter adapter bracket or for high temperature applications. The POD Extension is used to extend the connection away from the meter.

There are four POD Extension models available.

49754: Fork Drive with Buna-N O-Ring
(Use with POD1 or POD5)

49756: Fork Drive with Teflon O-Ring
(Use with POD2)

49757: Blade Drive with Buna-N O-Ring
(Use with POD1 or POD5)

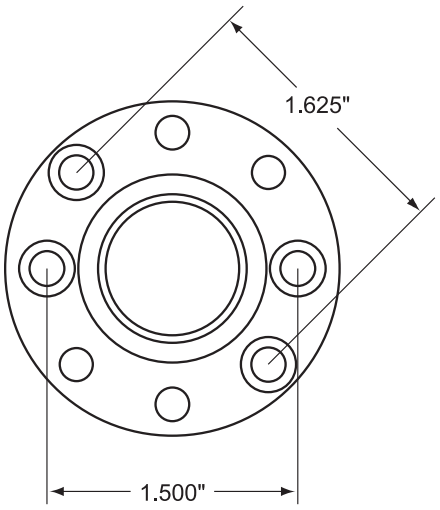
49759: Blade Drive with Teflon O-Ring
(Use with POD2)

NOTE: Regardless of the POD Extension being used, the POD Pulser must be a FORK drive pulser.

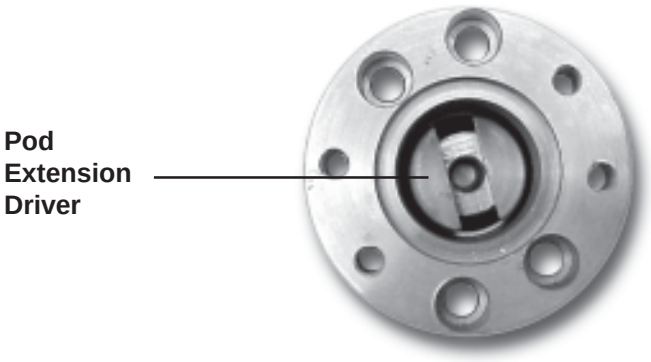
Once the existing hardware has been removed as described on Page 4, the POD Extension can be installed.

1. Verify that the proper POD Extension Model was obtained by comparing the driver tang on the POD Extension to the driver tang on the packing gland that was removed in Step 5 of **Removing Existing Hardware** on Page 4. There are two types of Packing Gland/POD Extension driver tangs: **blade** type and **fork** type. Blade type packing glands must be replaced with blade type POD Extensions. Fork type packing glands must be replaced with fork type POD Extensions.

2. Install the POD Extension using the two screws provided. There are two sets of holes in the POD Extension for these screws; one set is 1.625” apart and the other is 1.5” apart. Line up the holes with the meter to determine which set to use. Tighten the screws and torque them to 21-25 inch-pounds.



3. Once the POD Extension is in place, the POD may be installed onto the POD Extension. Align the POD Fork Tang with the internal POD Extension Driver. Use the two screws provided to mount the POD to the POD Extension using two of the tapped holes in the POD Extension. Using a 7/32” box end wrench, tighten the screws and torque them to 21-25 inch-pounds.



4. Proceed to Page 7 for wiring instructions.

Wiring the POD

Wiring Conduit System

When wiring the POD, the wires must enter through the POD's conduit hub. For explosion proof rated systems (Class I, Div 1.), the wiring must be in rigid conduit that is rated for explosion proof installation. The conduit must be engaged five (5) full threads into the female hub on the POD to meet explosion proof requirements.

When installing in a Division 2 location, use either rigid conduit, flexible conduit, or no conduit. When no conduit is used, the instrument cable must be brought into the POD conduit hub using a cable gland to seal the wiring to maintain the Enclosure NEMA 4X rating. Regardless of the type of connection used, thread sealant should be applied to prevent moisture from getting into the POD electrical housing.

Wiring Cable

Multi-wire cable with an overall shield is recommended for POD wiring. Use individual wires between 16 and 20 AWG or shielded cable no less than 22 AWG.

Cable runs up to 5000 ft (1524 m) are possible, however cable runs over 200 ft (61 m) should use lower AWG wire to reduce the IR voltage drop and the inter-wire capacitance. In addition, long runs may require a lower value pull-up resistor due to the additional cable capacitance that the pulser must drive. Cable that has a metalized foil plastic shield with a drain wire is recommended over cable with woven shields because it is easier to terminate the drain wire type cable.

Terminal Block

Removing the cover of the POD will expose a 4 position terminal block for connection to the user's electrical system. The terminal block can be unplugged from the board for ease of wiring. Pull it straight up to remove.

The terminal block screws require a straight blade screwdriver with a tip less than 1/8" wide. Before inserting wires into the terminal block, strip ¼" of insulation off each wire. Turn each terminal screw counterclockwise a few turns to make sure that the wiring slot is fully open to accept wire. Insert the stripped end of the wire and tighten the terminal block screw.

Plug the terminal block back into the board if it was removed. Be sure it is properly oriented with the four pins.

Wiring Configurations

The wiring configuration used depends on the system needs. The POD can be wired using only one of the two channels (Channel A or B) if the flowmeter has flow in only one direction. To detect both forward and reverse flow, both channels, which are in quadrature to each other, must be used. Channel A will lead Channel B by 90º in one flow direction and Channel B will lead Channel A in the reverse direction. Quadrature is required in most Weights & Measures approved installations.

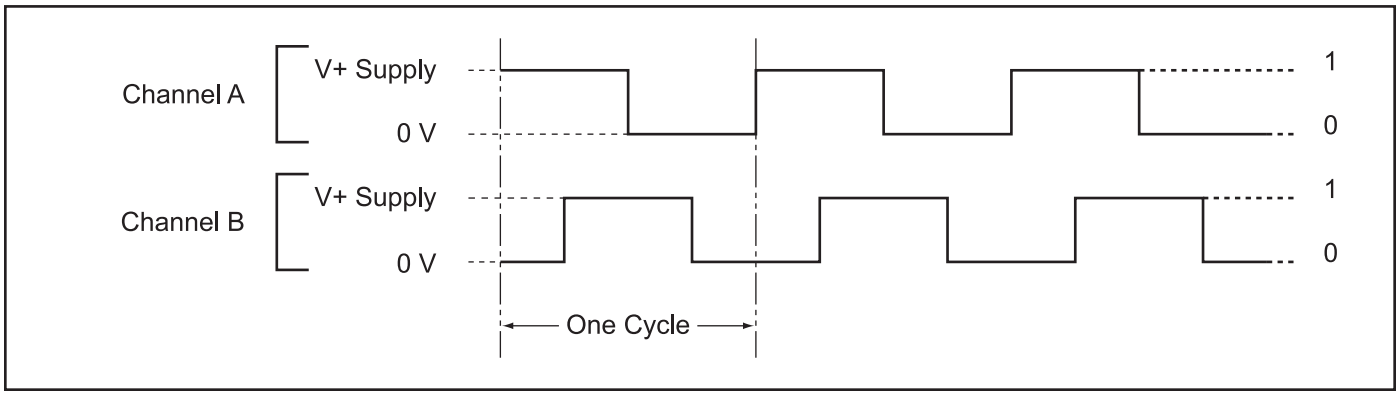
Conversion to Open Drain Output

As supplied by the factory, the POD has a 1.0 KΩ pull-up resistor to the positive power supply on each output transistor. The unit can be modified in the field to provide true Open Drain (Open Collector) outputs if desired. To modify the POD to Open Drain outputs, follow these steps.

1. Turn off power to the unit and remove the cover by turning it counterclockwise.
2. Loosen the three circuit board mounting screws using a Philips screwdriver. Remove the entire circuit board assembly from the POD housing.
3. Clip out R1 and R2 using a sharp, diagonal cutter.
4. Reassemble the unit.

Signal Output

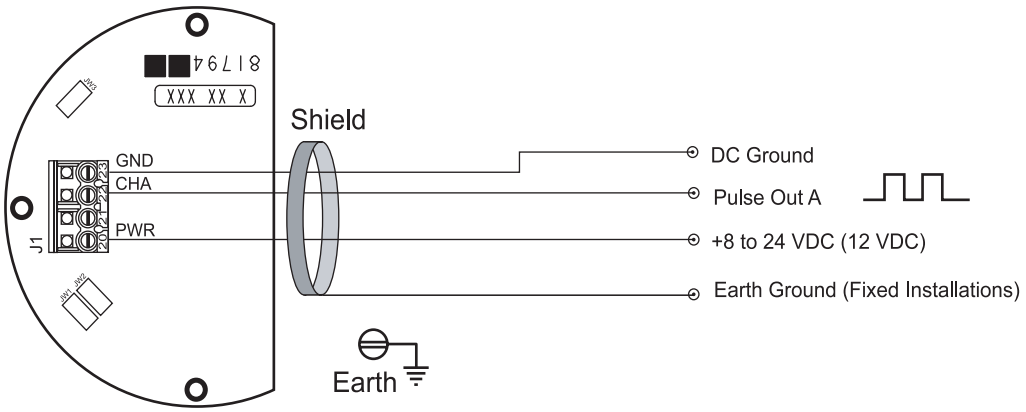
The diagram below shows the voltage output for a clockwise rotation of the Pulse Output Device (POD) with Channel A leading Channel B. For reverse flow applications (counterclockwise) Channel B leads Channel A.



Wiring Diagrams

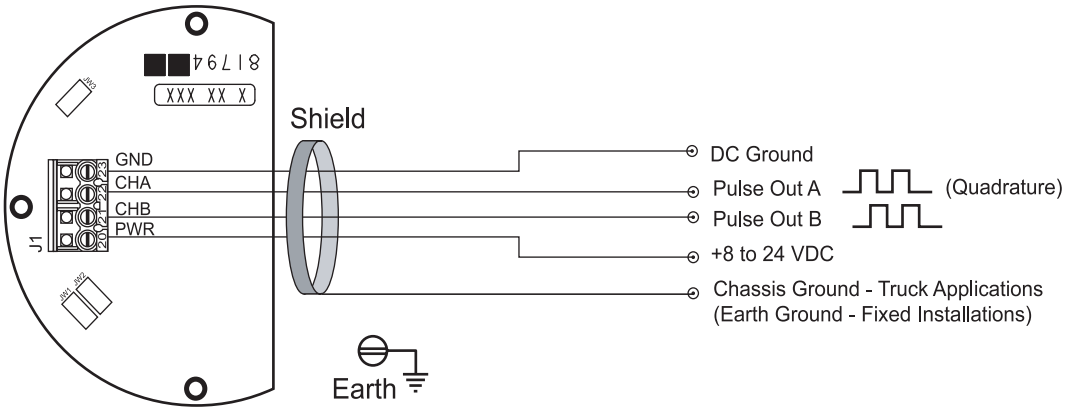
(For PODs with Serial Number 04-24531 and higher)

Single Channel Applications (405LR/414LR)



Description	POD: J1 Terminal	405LR/414LR Terminal
Power	20	11 (+12 VDC)
Channel A or B	21 or 22	9
Ground	23	12
Shield Wire	No Connection	Earth Ground Screw

Dual Channel Quadrature Applications (LectroCount LCR, LCR-II™, & LC³)



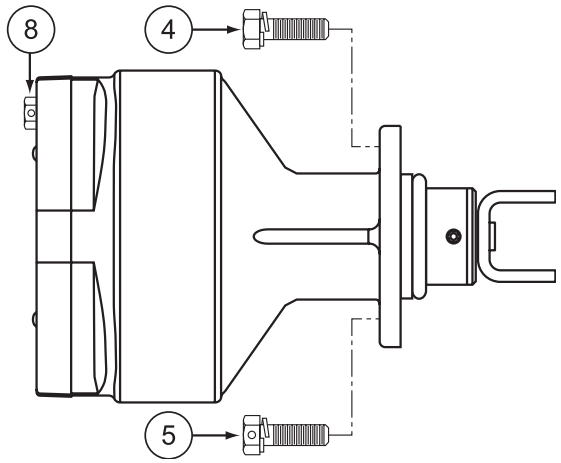
Description	POD: J1 Terminal	LCR, LCR-II™: J8	LC³: J3
Power	20	31	19
Channel B	21	34	17
Channel A	22	33	18
Ground	23	38	15
Shield Wire	No Connection	J6-13	14

Wiring Information

1 Use metallic conduit with individual wires or use 3 conductor, 22 AWG, shielded cable.
2 Strip 1½" off of outer sheathing. Remove exposed shield and drain wire and then tape.
3 Strip ¼" insulation from each conductor and connect to the terminal blocks.

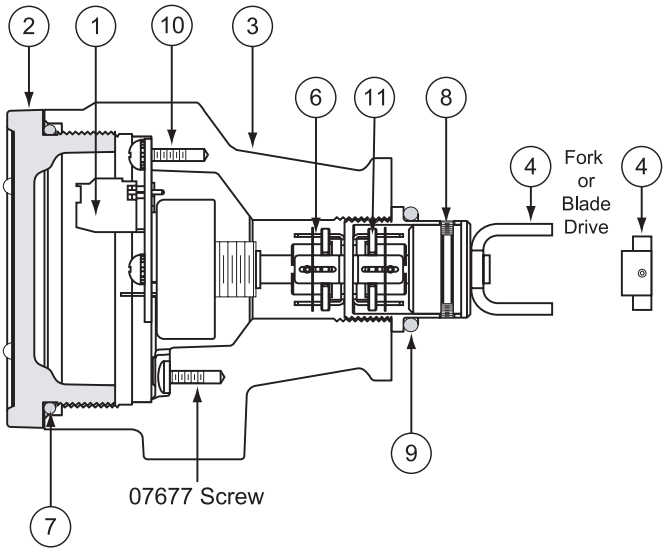
POD Assemblies

Item No.	Description	Part No.
4	Screw, #10-24 x .625	09079
5	Screw, #10-24 x .625	40107
8	Screw, #8-32 x .625	08192



POD Internal Components

Item No.	Description	Part No.
1	PC Board Assembly	(See Below)
2	Cover Assembly	
3	Housing Assembly	
4	Drive Assembly	
5	Screw #10-24 x .625	
6	Hub Magnet Assembly	
7	O-Ring, Buna-N	
8	Screw, #5-40 x .125	
9	O-Ring, Buna-N or Teflon	
10	Screw, #6-32 x .375	
11	Hub Magnet Assembly	



Model No.	POD1	POD2	POD3	POD4	POD5
Item No.	**Part No.**				
1	81794	81794	81794	81794	817941
2	81164	81164	81164	81164	81164
3	N/S*	N/S*	N/S*	N/S*	N/S*
4	81165	81165	81172	81172	81165
6	N/S*	N/S*	N/S*	N/S*	N/S*
7	09212	09212	09212	09212	09212
8	09211	09211	09211	09211	09211
9	06856	09151	06856	09151	06856
10	08177	08177	08177	08177	08177
11	81159	81159	81159	81159	501241

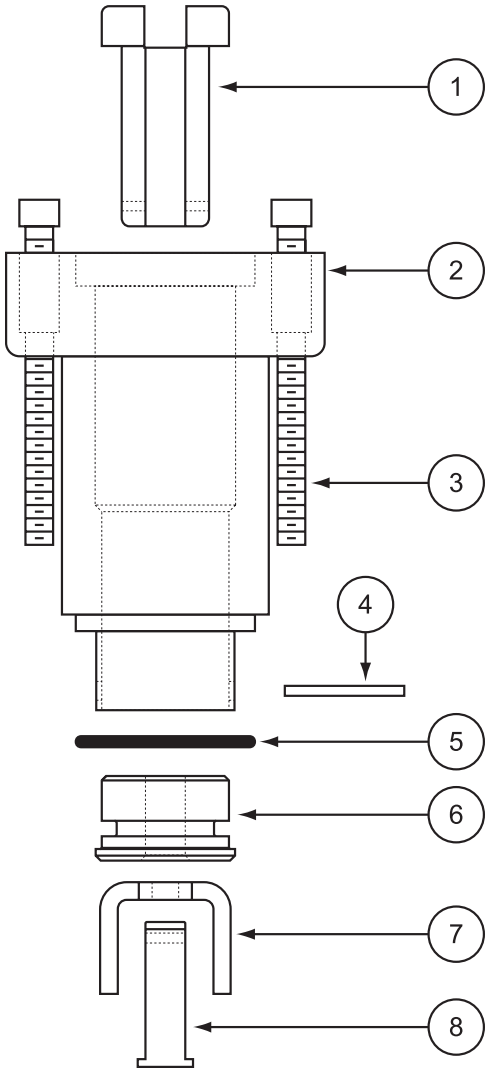
**N/S = Not for Sale*

Illustrated Parts Breakdown

POD Extension

Models 49754 & 49756

Item No.	Description	Part No.
1	Pulser Extension Driver	N/S*
2	Pulser Housing	N/S
3	Screw, #10-24 x 2.00	09228
4	Dowel Pin	N/S
5	O-Ring, Buna-N (**49754**)	06856
	O-Ring, Teflon (**49756**)	09151
6	Mag Bearing	N/S
7	**Fork** Driver	48282
8	**Fork** Drive Shaft	N/S

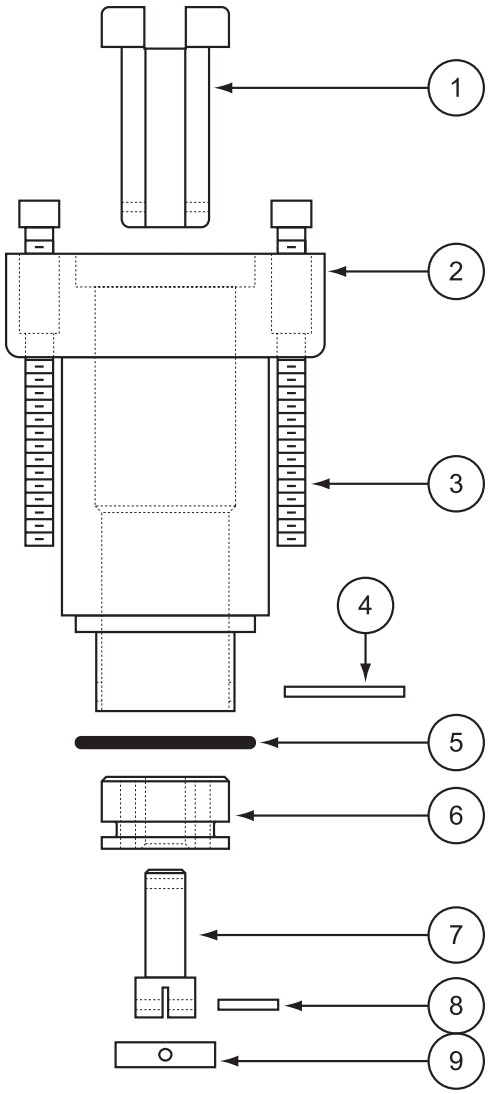


**N/S = Not for Sale*

POD Extension

Models 49757 & 49759

Item No.	Description	Part No.
1	Pulser Extension Driver	N/S
2	Pulser Housing	N/S
3	Screw, #10-24 x 2.00	09228
4	Dowel Pin	N/S
5	O-Ring, Buna-N (**49757**)	06856
	O-Ring, Teflon (**49759**)	09151
6	Mag Bearing	N/S
7	**Blade** Driver	N/S
8	Roll Pin	06051
9	Drive **Blade**	40812



**N/S = Not for Sale*

Technical

Fuelhouse and Commander Dispenser Control

The following Technical Data sheet is designed to assist the installer with understanding the input/ output control signals to the dispenser control board and how they affect the units operation. It is intended as a supplement to the wiring information supplied with the dispenser.

Table 1 lists the field wiring connections to the board. This list only represents control wiring to/ from the CPU board that must be considered when hooking up the dispenser to an external control device such as a card access system or console. Internal dispenser wiring is not represented in the list.

Table 1

Terminal Connection	Signal Name	Description	Input or Output	Signal Type
TB1-8	AC Power	AC source for AC output control signals.	Input	110VAC referenced to TB1-7
TB1-7	AC Neutral	AC Neutral reference for AC input control signals.	Input	AC Neutral
TB1-6	Earth Ground	Earth Ground.	Input	Earth Ground
TB4-8	On/Off Lever Signal	Activity signal from the On/Off lever on the dispenser.	Input	Low Voltage (12V) - Input from proximity switch
TB1-1	Dispenser Authorize	External signal to the dispenser authorizing its use.	Input	110VAC referenced to TB1-7. 10mA max load.
TB1-3	Pump Start output	Output from the dispenser that can be used as a pump start signal.	Output	110VAC referenced to TB1-7. 100W max load.
TB3-7	Pulse Out (+)	Pulse output. Pulse signal is referenced to TB5-6. See programming section to configure for volumetric or penny pulse output. See reverse for wiring details.	Output	Open-Collector Drain (DC)
TB3-8	Pulse Out (-)	Reference signal for penny pulse output. See reverse for wiring details.	Output	Open-Collector Source (DC)

Dispenser Operation:

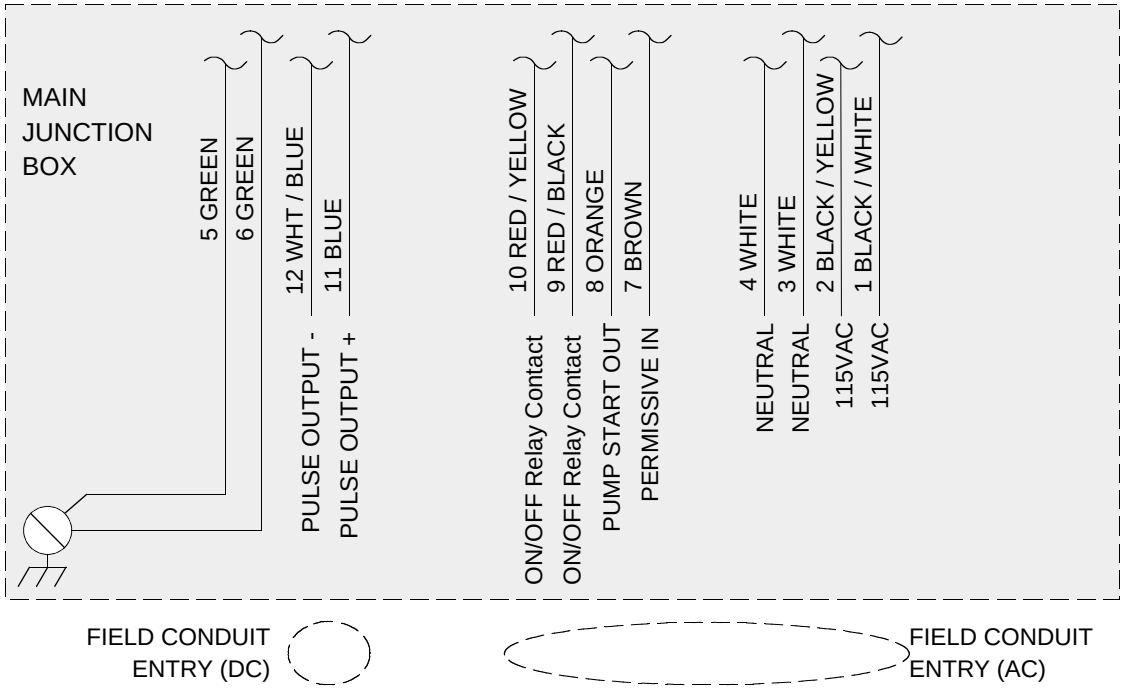
AC Inputs:

The CMD dispenser requires both the Dispenser Authorize (TB1-1) and the On/Off Lever to be active for the dispenser to operate. The Dispenser Authorize signal voltage is normally supplied by an external control device such as a card reader or console. If no external Authorize signal is available, the unit can be set in a 'stand alone' mode by turning dip switch position 1 to the 'ON' position. See 'Dispenser Programming" in this manual.

When both signals are active, the dispenser will reset the displays and turn on the Pump Output signal. If the board is set to do a SEGMENT test on the displays, the solenoid will open after a 5 second display. If no segment test is done, the solenoid will open when the Pump Output signal becomes active. If either control signal is removed (turned off), the solenoid will immediately close and the dispenser goes inactive. For the dispenser to go active again, both signals must be cycled off then on again. They can be turned off and on in either order, and do not necessarily need to be off at the same time.

DC Pulse Outputs:

The dispenser can produce a 'Penny Pulse' or a 'Volumetric Pulse' on TB3-7 and TB3-8 during the fueling operation. The Penny Pulse Output supplies a pulse out for every cent of product dispensed by the system. The Progammable Pulse Output can be set to supply 10 or 100 pulses for every unit volume. See 'Dispenser Programming' in this manual for further details.



NO.	DISCRIPTION
AC CONNECTIONS	
1	115 VAC
2	115 VAC
3	NEUTRAL
4	NEUTRAL
5	EARTH GROUND
6	EARTH GROUND
7	PERMISSIVE IN
8	PUMP START OUT
9	ON / OFF Relay Contact
10	ON / OFF Relay Contact
DC CONNECTIONS	
1	PULSE OUTPUT +
2	PULSE OUTPUT -
3	NO CONNECTION
4	NO CONNECTION
5	NO CONNECTION
6	NO CONNECTION

Electrical Specification:

1. Power Supply AC-1, 2 115VAC / 60Hz 9A
   Optional 220VAC / 50Hz available
2. Permissive IN: 20mA @ 115VAC / 60Hz
3: Pump Start Out: 0.5A @ 115VAC / 60Hz
4. ON/OFF Relay: Dry contact rated 1A VAC
   Contact Opens and closes with nozzle
   hook handle

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FUELHOUSE TERMINAL
WIRE DESCRIPTIONS

DATE: 11/20/01
DRAWN BY: CAT
SCALE: NTS

DRAWING NUMBER: 91-01A65.1

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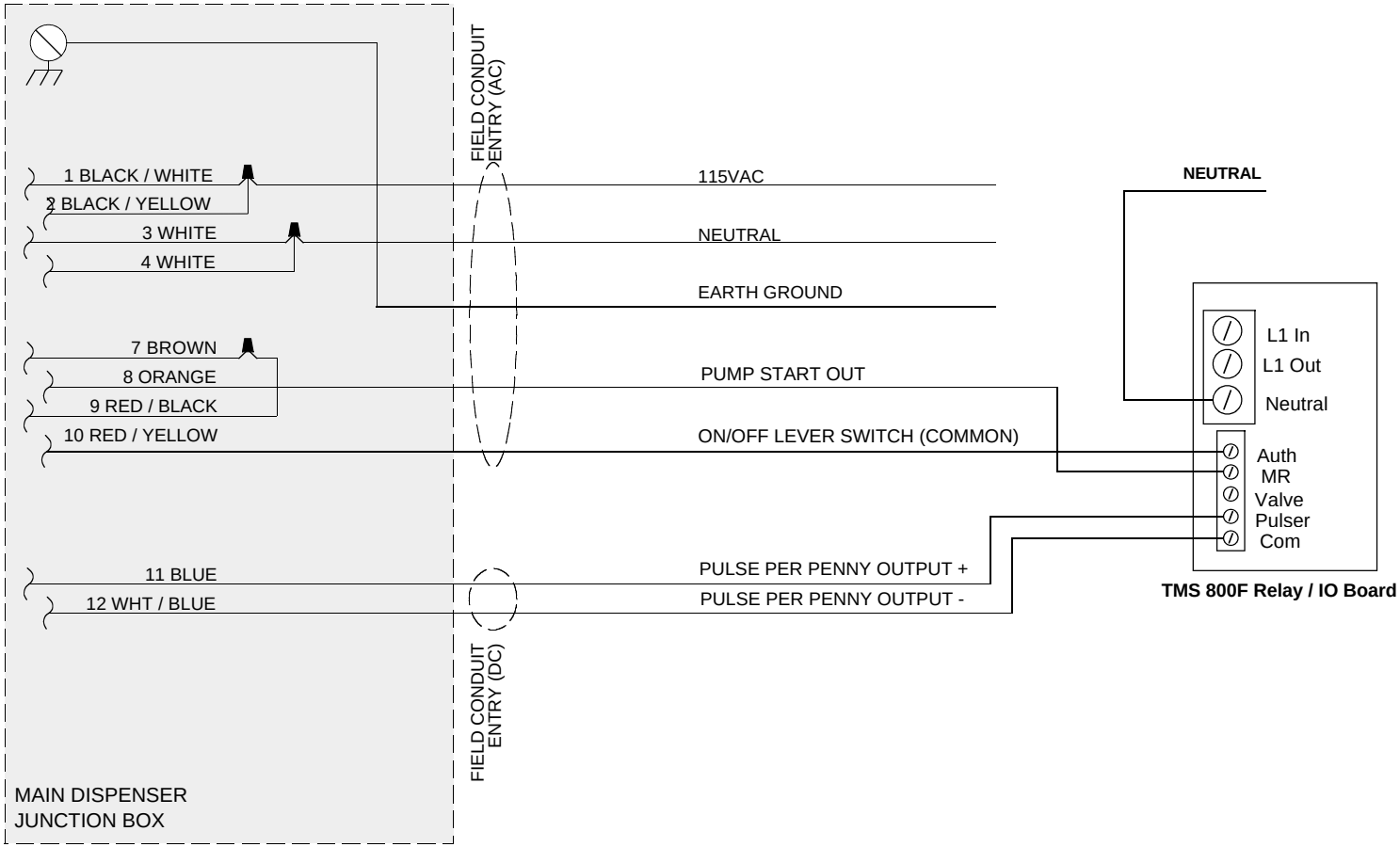

*NOTE:
1. ONLY FIELD WIRING CONNECTIONS SHOWN IN MAIN JUNCTION BOX.

NO.	DESCRIPTION	DATE
1.	WIRING REVISION	2/1/2002

REVISIONS

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FUELHOUSE / CMD-501 TO TMS-800F CONSOLE

DATE: 11/20/01 | DRAWN BY: CAT

SCALE: NTS | PART NO:

DRAWING NUMBER: 91-01A68.2

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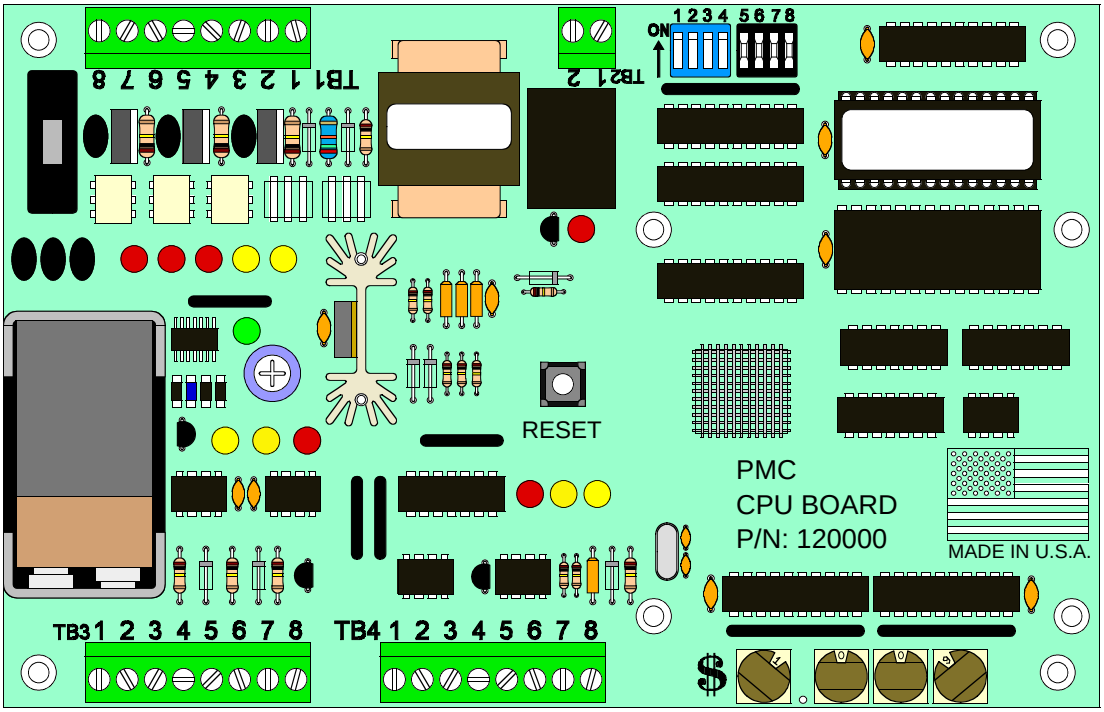

TB-1 AC POWER

Terminal	Connection	Type
1.	External Permissive Input	Input
2.	Dispenser Handle Input	Input
3.	Pump Start Output	Output
4.	Solenoid #1 Output	Output
5.	Solenoid #2 Output	Output
6.	Earth Ground	Input
7.	AC Neutral	Input
8.	AC Power	Input

TB-2 RELAY CONTACT

Terminal	Connection
1.	Nozzle Switch Relay Contact Normally Open
2.	Nozzle Switch Relay Contact Common

TB-3 DC

Terminal	Connection	Type
1.	+12 VDC Power Supply	Input
2.	DC Ground	Input
3.	+12 VDC	Output
4.	DC Ground	Output
5.	Meter Pulse Input (Channel A)	Input
6.	Meter Pulse Input (Channel B)	Input
7.	DC Pulse Out +	Output
8.	DC Pulse Out -	Output

TB-4 DC

Terminal	Connection	Type
1.	+12 VDC	Output
2.	DC Ground	Output
3.	Display Communications +	Output
4.	Display Communications -	Output
5.	Volume Pulse Out	Output
6.	+12 VDC	Output
7.	DC Ground	Output
8.	ON / OFF Lever Input	Input

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CPU BOARD P/N 120000
TERMINAL DESCRIPTIONS

DATE: 2/28/03
DRAWN BY: CAT
SCALE: NTS
DRAWING NUMBER: 91-03A44

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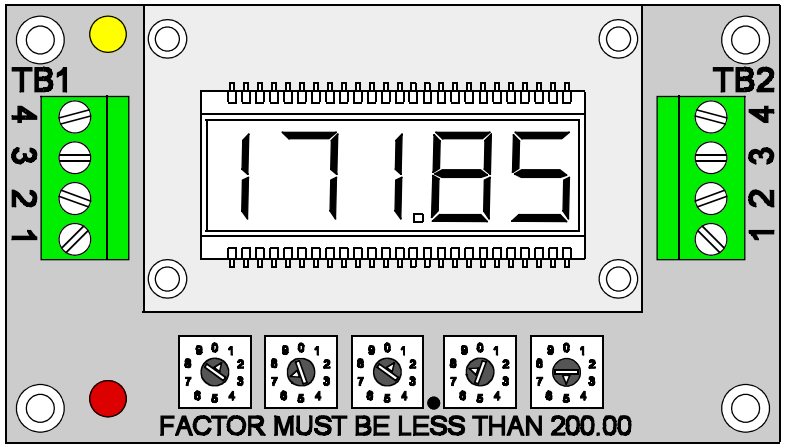
REVISIONS		
NO.	DESCRIPTION	DATE



NO.	DISCRIPTION
TB1	
1	+12 VDC SUPPLY
2	DC GROUND (COMMON)
3	CHANNEL 1
4	CHANNEL 2
TB2	
1	+12 VDC SUPPLY
2	DC GROUND (COMMON)
3	CHANNEL 1
4	CHANNEL 2

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110500C FACTOR BOARD

DATE: 9/22/03

DRAWN BY: CAT

SCALE: 1" = 1"

DRAWING NUMBER: 91-03A132

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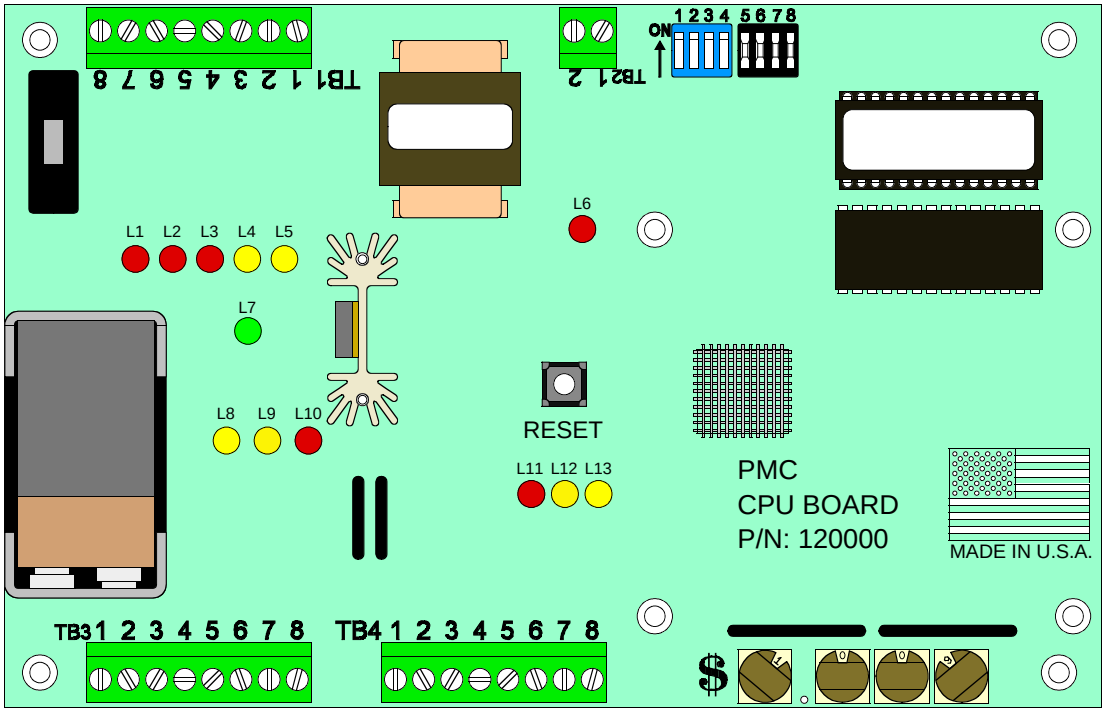

LED INDICATORS

LED Number	Function	Color
L1	Solenoid #2	Red
L2	Solenoid #1	Red
L3	Pump Start Out	Red
L4	Dispenser Handle (AC)	Yellow
L5	External Permissive	Yellow
L6	Relay Energized	Red
L7	+12 VDC OK	Green
L8	Pulse Input (Channel A)	Yellow
L9	Pulse Input (Channel B)	Yellow
L10	Programmable Pulse Out	Red
L11	Volume Pulse Out	Red
L12	Dispenser Handle Switch (DC)	Yellow
L13	AC Power Detect	Yellow

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CPU BOARD P/N 120000
LED FUNCTIONS

DATE: 2/28/03
DRAWN BY: CAT
SCALE: NTS

DRAWING NUMBER: 91-03A45

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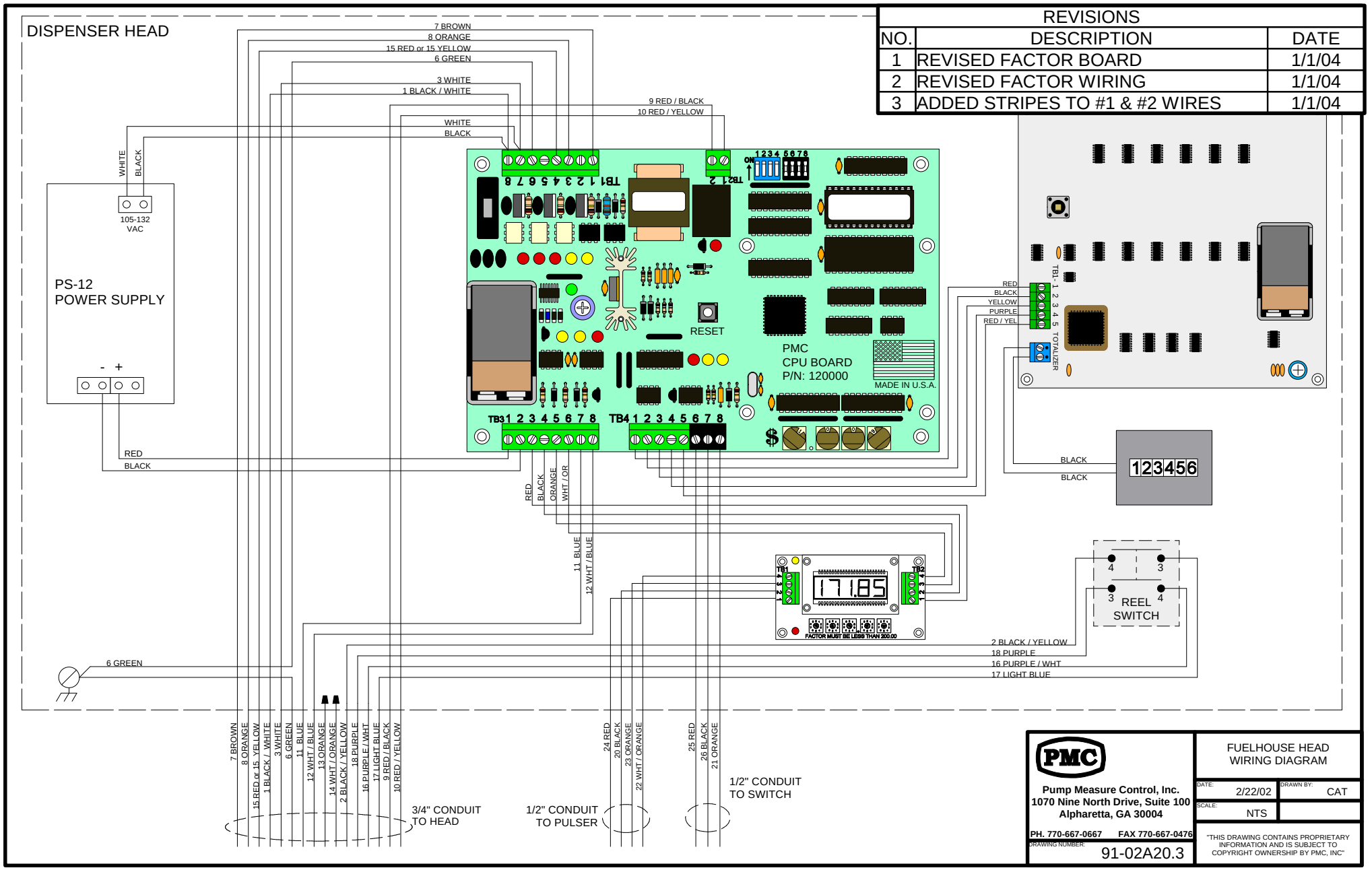

REVISIONS		
NO.	DESCRIPTION	DATE
1	REVISED FACTOR BOARD	1/1/04
2	REVISED FACTOR WIRING	1/1/04
3	ADDED STRIPES TO #1 & #2 WIRES	1/1/04

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DRAWING NUMBER: 91-02A20.3

FUELHOUSE HEAD WIRING DIAGRAM

DATE: 2/22/02 DRAWN BY: CAT

SCALE: NTS

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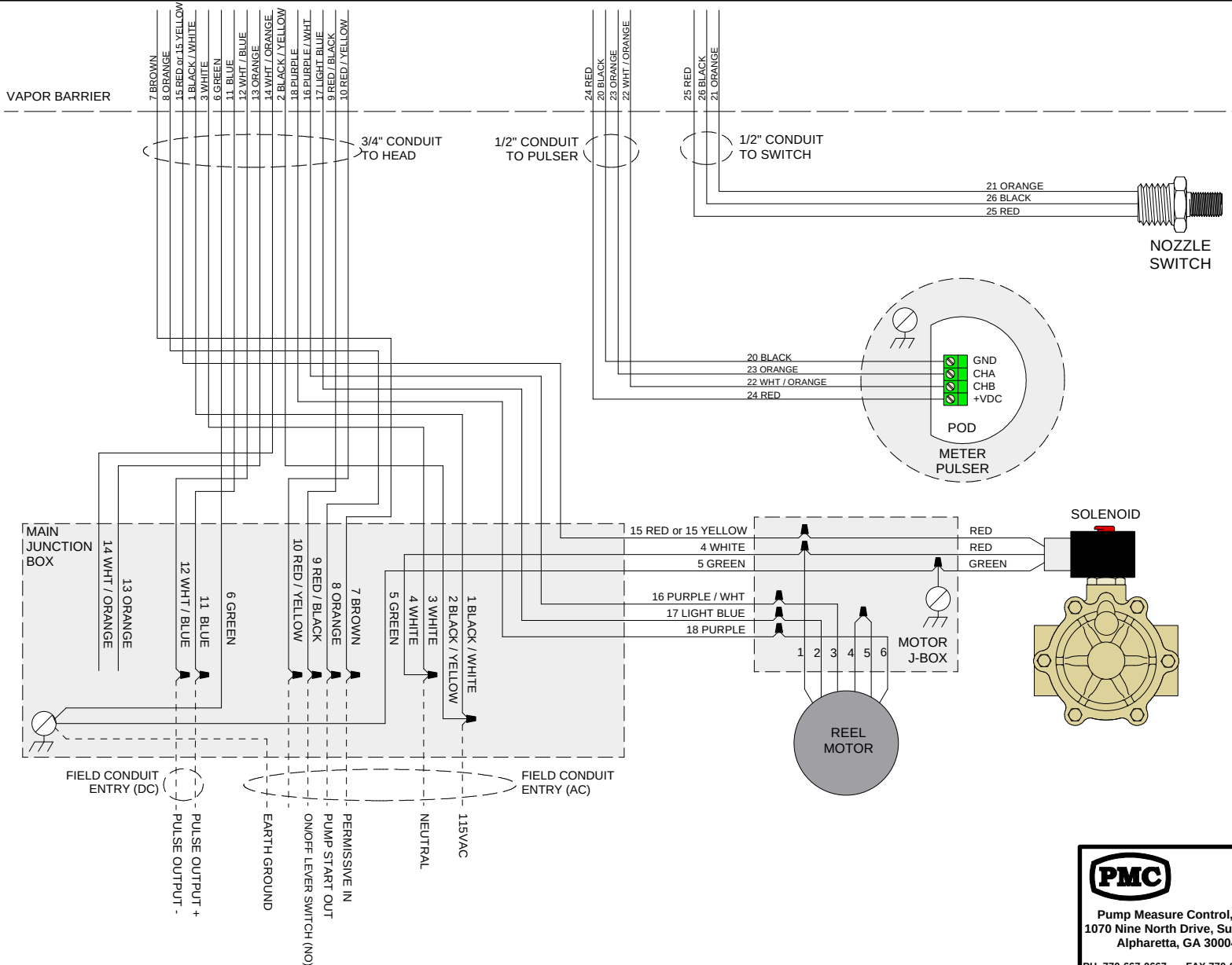

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DRAWING NUMBER: 91-02A21.1

FUELHOUSE LOWER UNIT WIRING DIAGRAM

DATE: 2/22/02 DRAWN BY: CAT

SCALE: NTS

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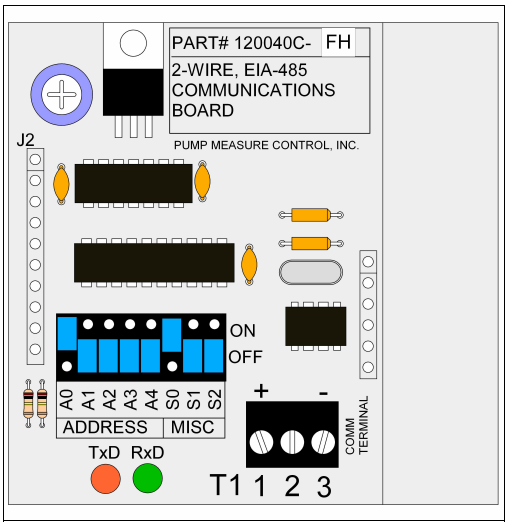
APPENDIX A

The 120040x-FH communications daughter board for the 110000 CPU board allows the FH dispensers to communicate via EIA-485 to a POS system that supports the PMC protocol. Contact PMC for POS systems that support this protocol. The board is red in color and is mounted to the CPU board on the right side. The board is shown in the box to the right.



120040x Comm Daughter Board.

Minimum Requirements for communications:
For the 120040x board to function, five conditions must exist:

1. It ***must*** be installed correctly on the 120000x CPU board.
2. The CPU board hardware version ***must*** be a 120000E hardware version or later as identified in the upper right corner with white text on a green background.
3. The firmware chip (U3 in the upper right of the CPU board) ***must*** be label as "120000x V2.00" or later.
4. The dispenser ***must*** be set for "Console Mode" as defined in the 'Programming' section (page 6) of the dispenser manual.
5. The 120040x board must be programmed for the correct address of the dispenser and protocol used.

PROGRAMMING THE 120040x COMMUNICATIONS BOARD

NOTE: AFTER CHANGING ANY SETTING, THE CPU BOARD MUST BE RESET BY CYCLING POWER OR PRESSING THE RESET BUTTON

Address / Protocol:
The 120040x communications board must be programmed via the 8 position jumper block located on the board. The communications address and protocol for the dispenser is set using these jumpers. See drawing #91-08G271 included on the following pages for definitions of these jumpers.

Product Price Per Volume:
When a 120040x communications board is installed on the 120000x CPU board, the price setting for the dispenser is determined by one of two methods.

Console Mode *(dip switch 1 on the main CPU board is in the 'OFF' position)*
In normal "Console Mode" operation, the price setting for the product dispensed is set remotely via communications from the POS system. The price setting switches SW2 thru SW5 on the CPU board should be set to '0.000' when in console mode to prevent confusion since they are not being used.

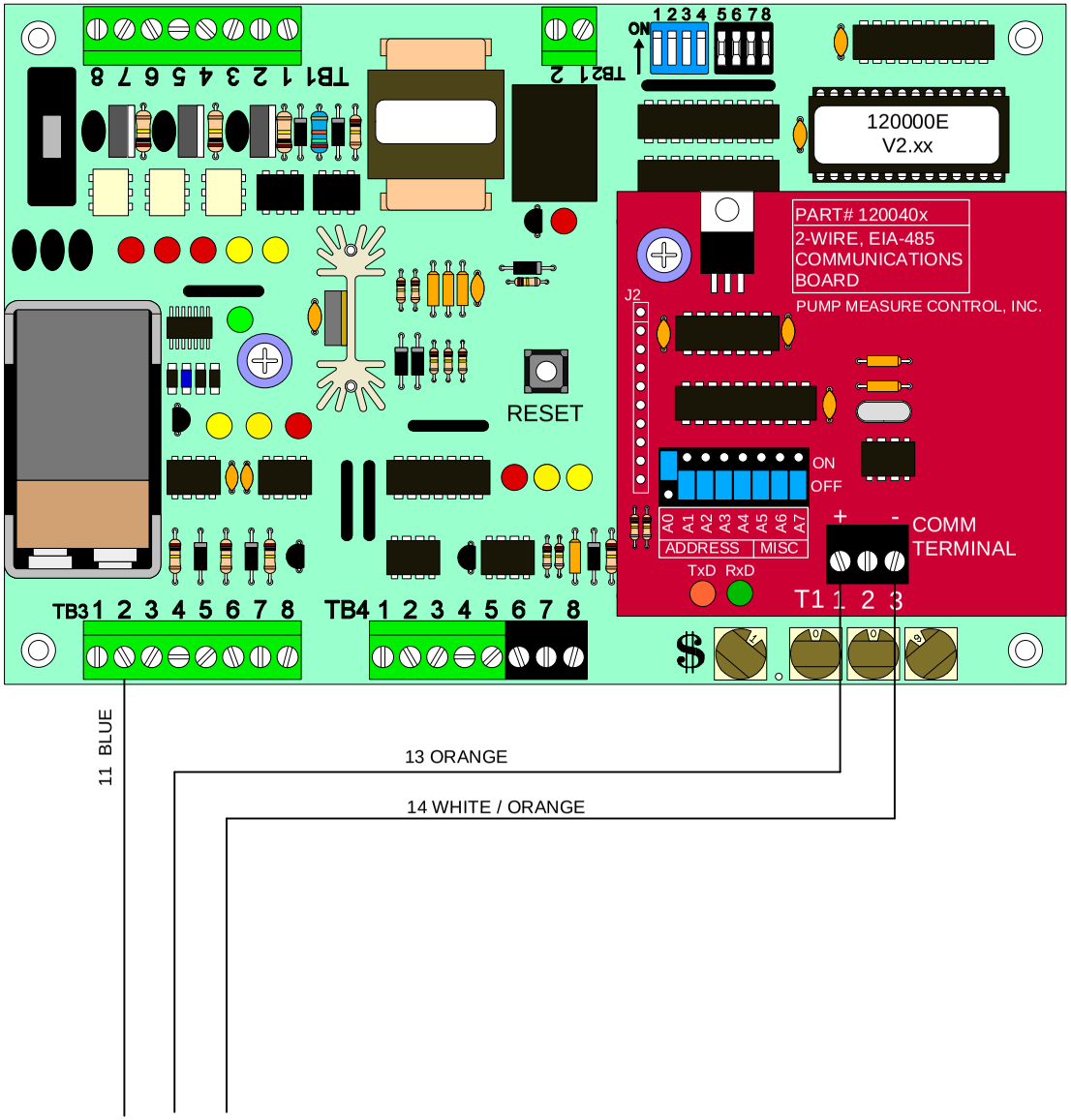
Stand Alone Mode *(dip switch 1 on the main CPU board is in the 'ON' position)*
If the dispenser is set to operate in "Stand Alone Mode", the 120040x board is not recognized by the CPU board and therefore, the price setting is determined by SW2 thru SW5 on the main CPU board (see programming section of dispenser manual). The price setting on the switches must be set to any value other then '0.000' for the dispenser to operate. Valid reasons for setting the dispenser to "Stand Alone Mode" with a 120040x board installed include failure of the POS system and initial startup / testing. When returning the dispenser to 'Console Mode', be sure to set the rotary price switches back to '0.000'.

NOTE: AFTER CHANGING ANY SETTING, THE CPU BOARD MUST BE RESET BY CYCLING POWER OR PRESSING THE RESET BUTTON

WIRING CHANGES FOR UPGRADE:

NOTE: REMOVE ALL POWER FROM DISPENSER PRIOR TO MAKING ANY WIRING CHANGES

See drawing 91-08G268 and 91-08G267 on the following pages for details.



*NOTES:

1. ONLY WIRING MODIFICATIONS SHOWN. ALL OTHER WIRING TO CPU BOARD MUST REMAIN UNCHANGED.
2. MOVE 11-BLUE WIRE FROM TB3-7 TO TB3-2. THIS CONNECTS THE BLUE WIRE TO DC GROUND ON THE BOARD. IT WILL SHARE THE TB3-2 TERMINAL POSITION WITH A BLACK WIRE.
3. FIND THE ORANGE & WHITE/ORANGE WIRES THAT ARE COILED ON THE LEFT SIDE OF THE ELECTRONICS HOUSING BEHIND THE FACE PLATE,
3. CONNNECT THE ORANGE WIRE TO T1-1 ON THE 120040x DAUGHTER BOARD.
4. CONNNECT THE WHITE / ORANGE WIRE TO T1-3 ON THE 120040x DAUGHTER BOARD.
5. THE CPU BOARD MUST HAVE V2.00 OR HIGHER VERSION OF FIRMWARE INSTALLED.

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FUELHOUSE COMM
WIRING MODIFICATIONS

DATE: 09/10/08
DRAWN BY: GJG
SCALE: NTS

DRAWING NUMBER: 91-08G268

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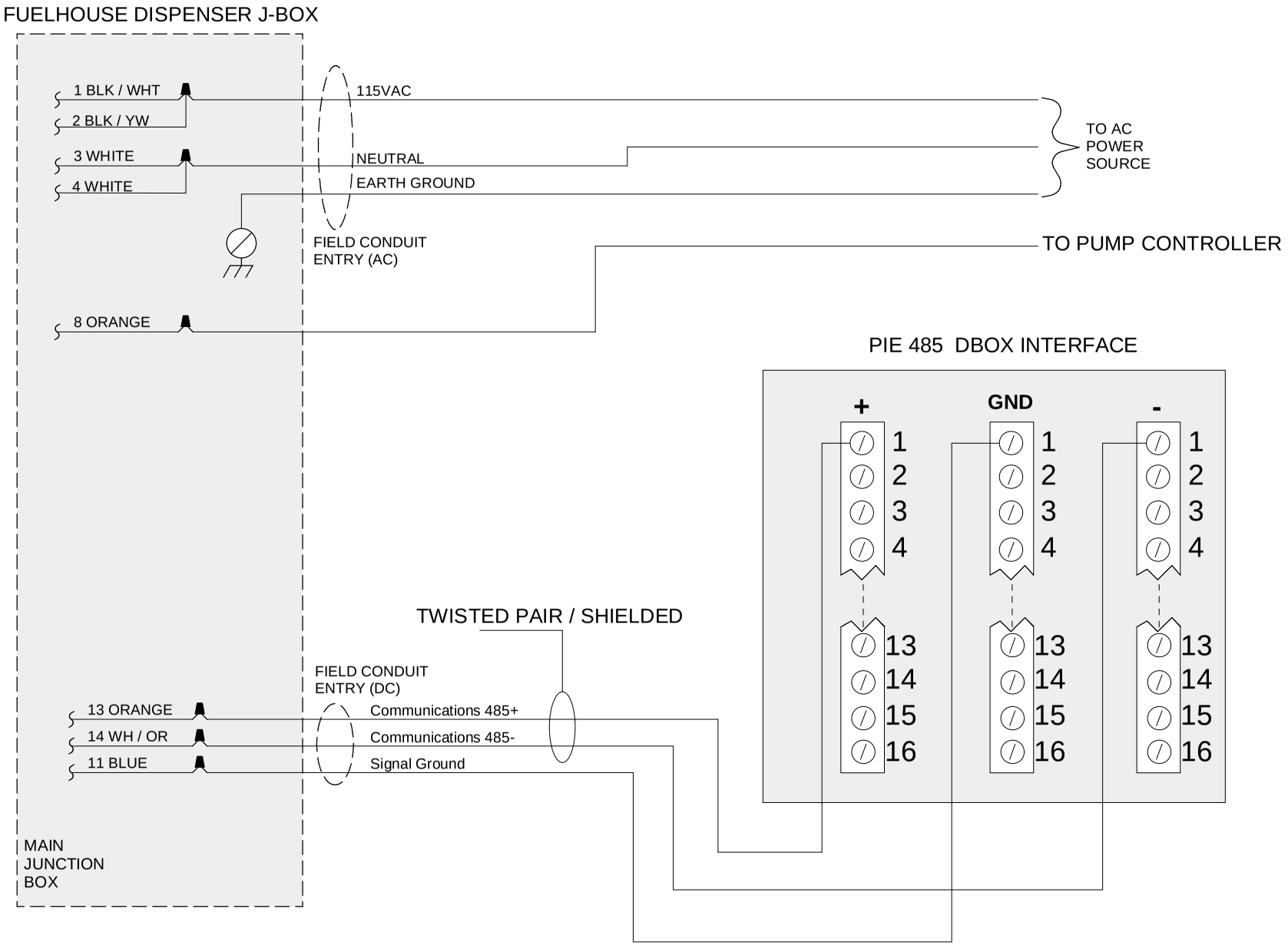

*NOTES:

1. ONLY FIELD WIRING CONNECTIONS SHOWN IN MAIN JUNCTION BOX
2. FOR COMMUNICATIONS, DISPENSER CPU BOARD MUST HAVE A 120040 DAUGHTER BOARD INSTALLED.
3. CONNECT COMMUNICATIONS WIRING TO TERMINALS IN PIE DBOX CORRESPONDING TO THE ADDRESS OF THE DISPENSER BEING CONNECTED. FOR EXAMPLE, WIRING FOR DISPENSER #1 IS SHOWN ABOVE.
4. THE PIE D-BOX MUST BE INSTALLED PER INSTRUCTIONS SUPPLIED WITH THE UNIT. (MANUFACTURED BY PROGRESSIVE INTERNATIONAL ELECTRONICS IN RALEIGH, NC.)
5. ORANGE #8 CAN BE USED AS THE PUMP START SIGNAL.

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DRAWING NUMBER: 91-08G267

FUELHOUSE / CMD-501 TOP
RS485 COMM D-BOX

DATE: 09/10/2008
DRAWN BY: GJG
SCALE: NTS

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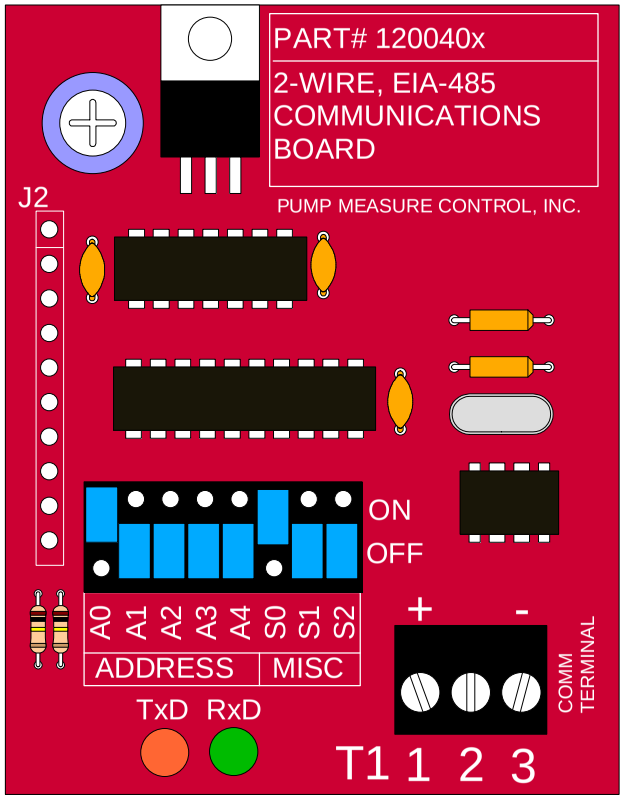
JUMPERS ON THE 120040 COMM BOARD SETS THE COMMUNICATIONS ADDRESS FOR THE DISPENSER AND AND THE TPYE OF PROTOCOL USED.

ADDRESS JUMPERS

ADDRESS	A0	A1	A2	A3	A4
0	NOT VALID				
1	ON	OFF	OFF	OFF	OFF
2	OFF	ON	OFF	OFF	OFF
3	ON	ON	OFF	OFF	OFF
4	OFF	OFF	ON	OFF	OFF
5	ON	OFF	ON	OFF	OFF
6	OFF	ON	ON	OFF	OFF
7	ON	ON	ON	OFF	OFF
8	OFF	OFF	OFF	ON	OFF
9	ON	OFF	OFF	ON	OFF
10	OFF	ON	OFF	ON	OFF
11	ON	ON	OFF	ON	OFF
12	OFF	OFF	ON	ON	OFF
13	ON	OFF	ON	ON	OFF
14	OFF	ON	ON	ON	OFF
15	ON	ON	ON	ON	OFF
16	OFF	OFF	OFF	OFF	ON
17	ON	OFF	OFF	OFF	ON
18	OFF	ON	OFF	OFF	ON
19	ON	ON	OFF	OFF	ON
20	OFF	OFF	ON	OFF	ON
21	ON	OFF	ON	OFF	ON
22	OFF	ON	ON	OFF	ON
23	ON	ON	ON	OFF	ON
24	OFF	OFF	OFF	ON	ON
25	ON	OFF	OFF	ON	ON
26	OFF	ON	OFF	ON	ON
27	ON	ON	OFF	ON	ON
28	OFF	OFF	ON	ON	ON
29	ON	OFF	ON	ON	ON
30	OFF	ON	ON	ON	ON
31	ON	ON	ON	ON	ON

MISC

PROTOCOL	S0	S1	S2
NOT USED	OFF	OFF	OFF
PMC	ON	OFF	OFF
NOT USED	OFF	ON	OFF
NOT USED	ON	ON	OFF
NOT USED	OFF	OFF	ON
NOT USED	ON	OFF	ON
NOT USED	OFF	ON	ON
NOT USED	ON	ON	ON



PMC

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DRAWING NUMBER: 91-08G271

120040x PROGRAMMING JUMPER DEFINITIONS

DATE: 09/10/2008

DRAWN BY: GJG

SCALE: NTS

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